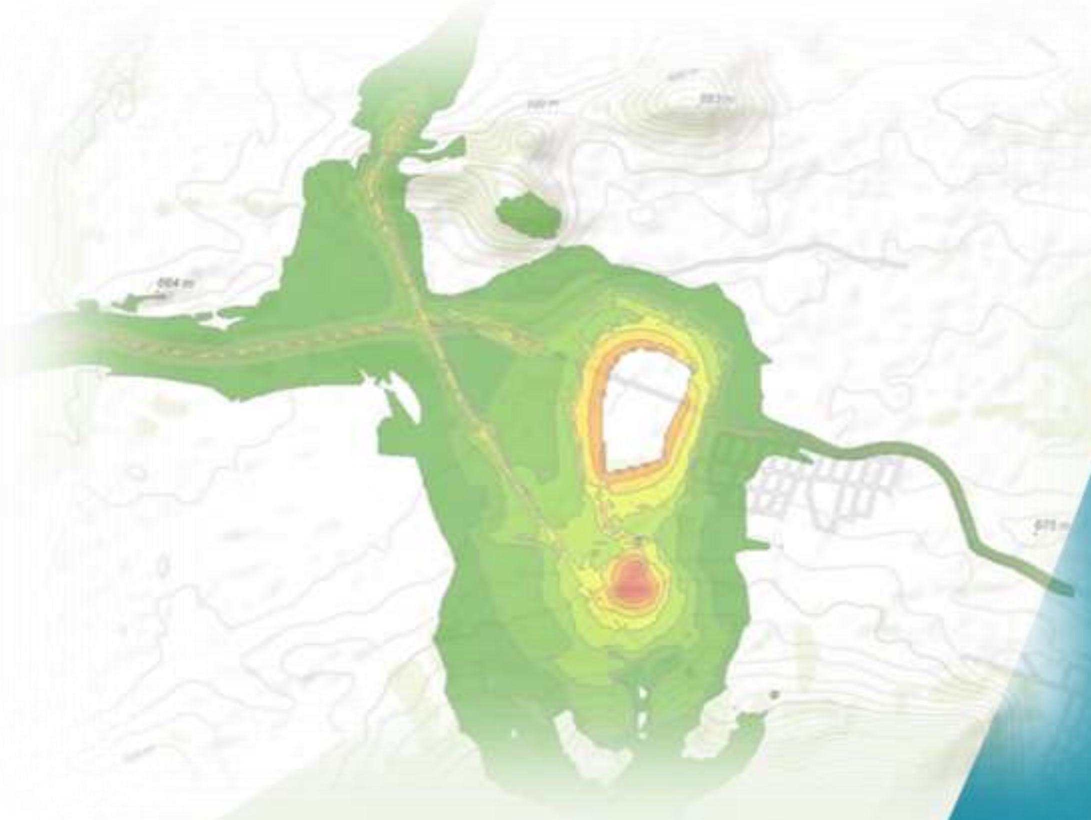

The Duel Coal Mine Environmental Noise Specialist Full Impact Assessment Report

Makhado Local Municipality, Limpopo Province

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Executive Summary

Subiflex (Pty) Ltd is proposing to operate a coal mine in Limpopo Province. The mine will combine the two methods of mining, opencast and underground, to extract the coal from the earth. The site is located in the far north of Limpopo close to the town of Tshipise. This report focuses on assessing and identifying the different applicable noise sources that will be introduced into the environment, also providing a way-forward to assess the impact of noise on the surrounding environment from the proposed new mine.

GENERAL DESCRIPTION OF STUDY AREA

The site is located in the rural mountainous region of the far north Limpopo Province of South Africa. The site is limited to the farms remain extent of the “The Duel” farm boundaries. The processing plant will be located in the southern most corner of the property while the opencast method of mining will start until underground mining must commence. The small informal village of Makushu is located on the boundary (south-eastern) of the mining property. The planned mining operations and activities are planned on the southern slopes of the mountain found on the farm. The main access road and village is also located on this southern slope.

The region is classified as rural, with small informal villages located close to the main access routes in the region. The noise climate found in the region is very low, that is mostly impacted by the existing noise source of the region, these are:

- Access gravel roads; and
- Mining activities in the region.

POTENTIAL ENVIRONMENTAL IMPACTS

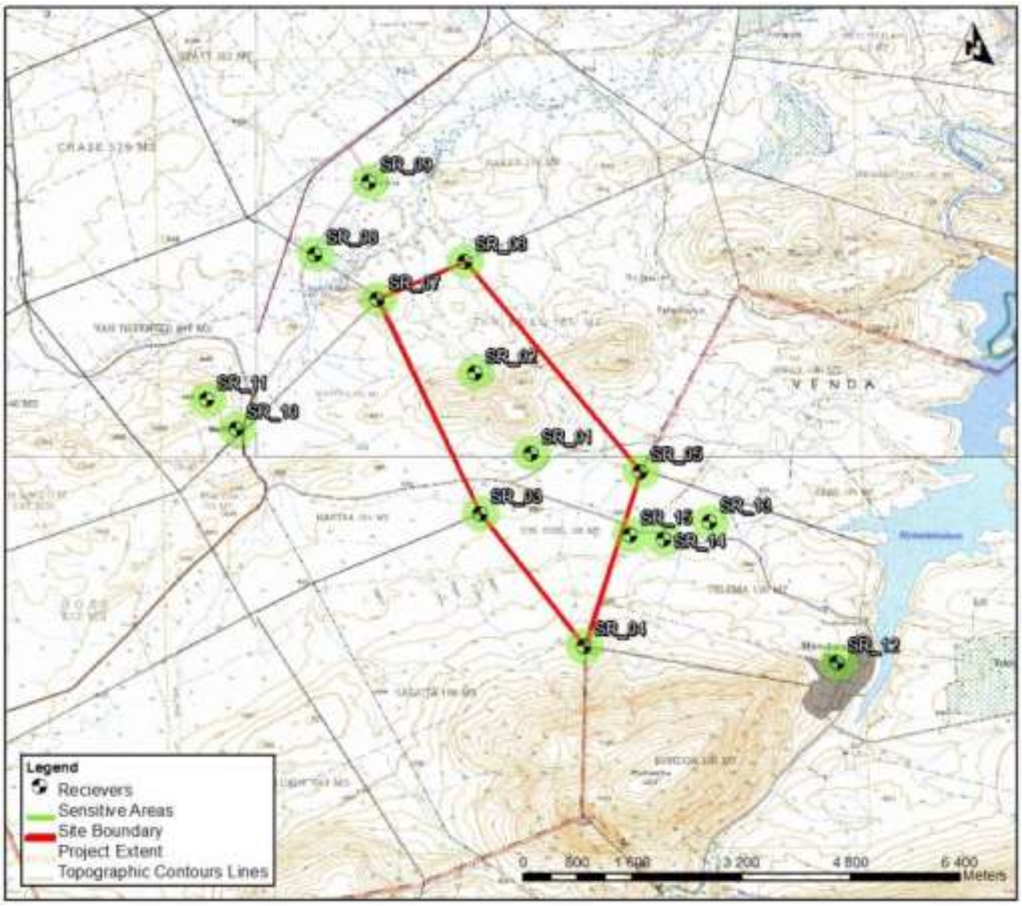
NOISE SOURCES

The existing noise sources and the potential planned noise source, associated with this project that might have an impact on the surrounding environment are presented below:

- Existing gravel access road (from site to National Highway 1);
- Some mining activity noises in the region;
- Future planned mining activities onsite;
- Future planned increase in traffic on the access road; and
- Neighbouring village noise (during the night).

NOISE SENSITIVE AREA

The noise sensitive sites/areas in the study area that are potentially affected by thedevelopment of the project on this site are indicated in the figure below.



EXISTING NOISE CLIMATE

The determination of the existing noise climate is based on the measurements and observations made in the area, and where relevant, also from the calculation of the noise from the traffic on the main access roads.

The proposed area on the farm The Duel is remote and is very quite, classifying the region as Rural Land-use (SANS 10103). It should be mentioned that the access road passing through the farm boundary does significantly impact on the ambient noise levels if a vehicle travels on the road.

PREDICTED NOISE CLIMATE

As mentioned above the two likely impact associated with the Duel Coal Project is the increase in traffic on the access roads to the site and all mining associated noise onsite of the mine.

1. The Duel Coal Project mining associated noises

   With the construction of the coal mine the noise climate close to the facility will alter in intensity, occurrence and frequency. The construction noise generated is temporary in nature and can be mitigated or stopped before significant harm is done to the environment. During the operation of the coal mine the main noise sources will emanate from transportation of run of mine (ROM), processing (crushing and screening), washing, waste rock transport, product loading and transport.

   The plant area will be active during the whole day (24/7), noise sensitive sites (in a rural setting) further than 2500 metres away from the Plant will not be impacted by the noise from the plant, however this distance will be reduced due to the vegetation and mountainous character of the region.

2. Coal mine generated traffic

   The total volume of traffic generated by the coal mine will be significant during both phases (construction and operational). As the existing infrastructure to handle the traffic is a gravel road, it is advised that the route be paved from an early start of the project.

In the study the three important receivers are the ones located in the closest community (east from the mine and within 250m of the boundary). The closest receiver to the mine is SR_15 and according to the IFC regulations regarding environmental noise, the receiver is impacted if the future calculate difference is higher than +3 dBA.

Scenario 02 – Construction Phase (Earth Clearing) – concluded that the day, night and day/night noise levels are all well below +3 dBA increase (actual maximum increase is during the day = +0.54 dBA).

Scenario 03 – Construction Phase (Site Plant Assembly) – concluded that the day, night and day/night noise levels are all well below +3 dBA increase (actual maximum increase is during the day = +1.94 dBA).

Thus the construction phase of the project is likely to have a minimal (negligible to very low) impact on the closest receiver and surrounding community.

Scenario 04 – Operation Phase – Opencast Mining – concluded that the day, night and day/night noise levels are all well below +3 dBA increase (actual maximum increase is during the day = +0.53 dBA) for the initial stages of the opencast pit development. During the later life cycle of the opencast pit (maximum opening and production) the noise is a cause of concern at the closest receiver located on the boundary of the site. The noise rating for the Day-Night level increases with +10.41 dBA

Scenario 05 – Operational Phase – Underground Mining - investigates the propagation of the sound generated by the mine during the underground operations of the mine. The terrain file included the full capacity of the waste rock stockpile, discard dump and open cast pit mine. The impact calculated at the closest receiver is above +3dBA and mitigation measures should be investigated for the mine to implement.

The mitigation scenario is based on the operational phases of the mine as these were identified as the loudest scenarios. Different mitigation measures were identified for the sources of the loudest noise received by SR_15. The mitigation measures reduced the noise received between -0.2 to -2 .0 dBA during the day and with -1.7 to -10.3 dBA during the night-time at SR_15. With these mitigation measures emplace, the day-time operations' noise will be in the acceptable range (+0.5 – +0.6 dBA increase from baseline). However, the night-time noise level increase from the baseline is well above +3 dBA. This is caused by the model assuming that the plant will process the ROM throughout the night (with active material handling source, hauling trucks travelling in and out of the plant to the pit, crushing and screening process active). It is suggested that the material handling be inactive during the night and the processing of ROM be limited.

In summary the mining project will not increase the noise level at the closest receivers in the region with more than +3dBA and is likely to have a very little to little impact on the noise climate of the region. The noise generated from the mine is strong in the lower end of the frequency spectrum (caused by heavy vehicles, machinery and crushing and screening). The noise frequency profile (day/night) at SR_15 will increase in the octave band of 32-64Hz and 8 kHz, while not increasing the single band noise level with more than 1 dBA.

To control the noise from the coal mining operations the following key points are highlighted by Royal HaskoningDHV to be investigated and implemented:

- Control of noise - Onsite
  - Avoid unnecessary revving of engines and switch off equipment when not required;
  - Keep internal hauling roads well maintained and avoid steep gradients;
  - Minimise drop height of materials;
  - Start up plant and vehicles sequentially rather than all together.
  - Ensure that all the equipment and operations employed at the site is of the latest and quietest technologies;
  - Fitment of additional or best available exhaust silencers or acoustic canopies on engines;
  - Where possible, attempt to enclose noise sources, if the sources enclose has a noise directivity ensure the noise is directed away from any communities;
  - Regular and effective maintenance by trained personnel is essential and will do much to reduce noise from plant and machinery;
- Controlling the spread of noise
  - Increase the distance from source to receiver – siting equipment and noisy activities as far as possible from the noise sensitive area or receivers;
  - Screening of noise sources, if it isn't possible to increase the distance, the alternative measure is to screen the noise source. Screening can make use of the natural environment, existing buildings and/or screens or earth berms. These screens should be placed in the direct line of sight to effectively reduce the noise received and the sensitive location.
- Noise control targets
  - Monitoring of noise at sites where noise is an issue should be regarded as essential. Measurements may be carried out for a number of reasons, including the following:
    - To allow the performance of noise control measures to be assessed;
    - To ascertain noise form items of plant for planning purposes;
    - To provide confirmation that planning requirements have been complied with.

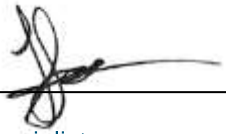
    Monitoring positions should reflect the purpose for which monitoring is carried out.

Declaration of Interest

I, Lodewyk Jansen declare that –

General Declaration:

- I act as the independent specialist in this application;
- I will perform work relating to the application in a manner, even if it results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have experience in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing – any decision to be taken with respect to the application by the competent authority; and – the objectivity of any report, plan, or document to be prepared by myself for submission to the competent authority; all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the National Environmental Management Act.



Signature of specialist

Royal HaskoningDHV (Pty) Ltd

Name of company (if applicable)

13 July 2015

Date

Glossary of terms

NOISE:	Unwanted sound that is annoying or interferes with listening. Not all noise needs to be excessively loud to represent an annoyance or interference.
SOUND:	Sound is an oscillation in pressure, stress particle displacement, particle velocity in a medium – in room temperature. (In air speed of sound is 1125'/second or one mile in 5 seconds.) Sound produces an auditory sensation caused by the oscillation.
ACOUSTICS:	The science of Sound. Its production, transmission and effects.
ABSORPTION:	The properties of a material composition to convert sound energy into heat thereby reducing the amount of energy that can be reflected.
ATTENUATION:	The reduction of sound energy as a function of distance travelled. (See also Inverse Square Law).
BACKGROUND NOISE:	The sum total of all noise generated from all direct and reflected sound sources in a space that can represent an interface to good listening and speech intelligibility. (Hearing impaired persons are especially victimized by background noise).
BARRIER:	Anything physical or an environment that interferes with communication or listening. A poor acoustical environment can be a barrier to good listening and especially so for persons with a hearing impairment.
BEL:	A measurement of sound intensity named in honour of Alexander Graham Bell. First used to relate intensity to a level corresponding to hearing sensation.
FREE FIELD:	Sound waves from a source outdoors where there are no obstructions.
FREQUENCY:	The number of oscillations or cycles per unit of time. Acoustical frequency is usually expressed in units of Hertz (Hz) where one Hz is equal to one cycle per second.
FREQUENCY ANALYSIS:	An analysis of sound to determine the character of the sound by determining the amount of sounds at various frequencies that make up the overall sound spectrum. i.e.: Higher Frequency Sound or Pitch vs. Low Frequency.
IMPACT SOUND:	The sound produced by the collision of two solid objects. Typical sources are footsteps, dropped objects, etc., on an interior surface (wall, floor, or ceiling) of a building.
INVERSE SQUARE LAW:	Sound levels fall off with distance travelled. Sound level drops off 6 dB from source point for every doubling of distance
NOISE REDUCTION COEFFICIENT (NRC):	The NRC of an acoustical material is the arithmetic average to the nearest multiple of 0.05 of its absorption coefficients at 4 one third octave bands with centre frequencies of 250, 500, 1000, 2000 Hertz.
NUISANCE:	A legal definition of a noise that offends or upsets the receiver because it is occurring at the wrong time in the wrong place or is of a character that annoys due to excessive tonal components or impulses.
OCTAVE BANDS:	Sounds that contain energy over a wide range of frequencies are divided into sections called bands. A common standard division is in 10 octave bands identified by their centre frequencies 31.5, 63, 125, 250, 500, 1000, 2000, 4000 Hz.
RESONANCE:	The emphasis of sound at a particular frequency.
RESONANT FREQUENCY:	A frequency at which resonance exists.
SEPTUM:	A thin layer of material between 2 layers of absorptive material. i.e.: foil, lead, steel, etc. that prevents sound wave from piercing through absorptive material.
SOUND ABSORPTION:	The property possessed by materials, objects and air to convert sound energy into heat. Sound waves reflected by a surface causes a loss of energy. That energy not reflected is called its absorption coefficient.
SOUND ABSORPTION COEFFICIENT:	The fraction of energy striking a material or object that is not reflected. For instance if a material reflects 70% of the sound energy incident upon its surface, then its Sound Absorption Coefficient would be 0.30.
SOUND BARRIER:	A material that when placed around a source of noise inhibits the transmission of that noise beyond the barrier. Also, anything physical or an environment that interferes with communication or listening. For example, a poor acoustical environment can be a barrier to good listening and especially so for persons with a hearing impairment.

SOUND LEVEL METER:	A device that converts sound pressure variations in air into corresponding electronic signals. The signals are filtered to exclude signals outside frequencies desired.
SPL: SOUND PRESSURE LEVEL:	Quantity used to describe the loudness of a sound. The sound pressure level is expressed in decibels and is measured with a sound level meter. For example, a conversation between two people inside an average-size room will produce an average "A" weighted sound pressure level of 50 to 55 lb.
TIME WEIGHTED AVERAGE (TWA):	The yardstick used by the Occupational Safety and Health Administration (OSHA) to measure noise levels in the workplace. It is equal to a constant sound level lasting eight hours that would cause the same hearing damage as the variable noises that a worker is actually exposed to. (This hearing loss, of course, occurs over long-term exposures.) Same as LOSHA.
WAVELENGTH:	Sound that passes through air it produces a wavelike motion of compression and Parefaction. Wavelength is the distance between two identical positions in the cycle or wave. Similar to ripples or waves produced by dropping two stones in water. Length of sound wave varies with frequency. Low frequency equals longer wavelengths.

1 Introduction

Royal HaskoningDHV was commissioned to undertake the environmental noise specialist studies to determine the potential noise impact on the surrounding environment from the planned coal mine on the remaining extent of the farm called “The Duel 186 MT”, located in the MakhadoLocal Municipality, Limpopo Province.

This report will assess the potential noise impact from all noise sources associated with the coal mine proposed at The Duel on the receiving environment. This assessment will highlight the existing noise conditions and character of the region, describe the methodology followed, list all noise sources and their associated sound power levels, describe different scenarios under investigation and will finish with a cumulative conclusion and recommendations (including environmental risk rating of each scenario).

This full impact assessment report follows on the previous scoping assessment completed in March 2015. The scoping phase is the environmental assessment stage of a project where issues are determined that should be addressed at subsequent stages (these can include impacts and preliminary alternatives). The scoping assessment recommended that a full impact assessment must be conducted based on the size of the project and the relative existing noise characteristics of the region. The report also listed different suggested scenarios to be assessed and also indicated details pertaining to the meteorological conditions to be used.

After the propagation modelling of the different scenarios are done, the results will be reviewed and environmental risk ratings will be assigned to each. If any of the scenarios identify some unacceptable increase in noise level at sensitive receptors, mitigation measures will be investigated.

1.1 Study Area Locality

Figure 2, below, indicate the locality of the site in the region of the far north Limpopo. The area is located northeast from the town LouisTrichardt, and southwest from the town called Tshipise. The Nzhelele dam is located 3.5km east from the site. Important to note the Nzhelele Nature Reserve – sensitive receptor

The local gravel roads provide access to the surrounding game farms and the community villages. There is a community village (Makushu Village) located on the property boundary of the southern section of The Duel farm (on its eastern side). The site is north from the Soutpansberg mountain range. Other close located villages are Mosholombe (< 1 km radius of MRA boundary) and Pfumembe (<3km radius of MRA boundary).

The site is accessible from the National Road (N1) located west from the site, taking the turn off towards the Nzhelele dam. The site is located 12km northeast along the gravel road. Although the region is accessible with gravel roads only, the area is supplied with electrical, water and sewage infrastructure.

The local community practises sustainable farming and the region is dominated by small villages, game farms and commercial farms.

1.2 Project Description

The Duel Coal Project will be a combination of open pit and underground mining and has a potential Life-of-Mine (LOM) of 24 years. The envisaged mining method for the open pit area is a conventional drill and blast operation with truck and shovel, load and haul.

Underground mining operations will commence from year 10 onwards for a period of 5 years. Access will be from selected positions in the open pit and the coal will be mined through the long-wall method. After underground activities are complete, the access to the underground areas will be closed, followed by the final rehabilitation of the open pit.

The proposed infrastructure to be developed includes:

- Coal Handling Processing Plant;
- Overburden Waste Dump;
- Temporary Discard Dump;
- Haul roads;
- Pollution Control Dams;
- Raw water storage facility and distribution systems;
- Access road; and
- Auxiliary infrastructure including a workshop and store, office and change house, electrical power supply and security fencing.

The washed coal will be transported via road to a nearby siding. The final discard material from the plant will be disposed of in the mined-out open pit. In the event that the pit is unavailable due to existing mining activities, the discard material will be placed on an interim surface discard dump, from where it will be reclaimed and dumped into the mined-out open pit towards the end of the mine life as part of the rehabilitation of the mining site.

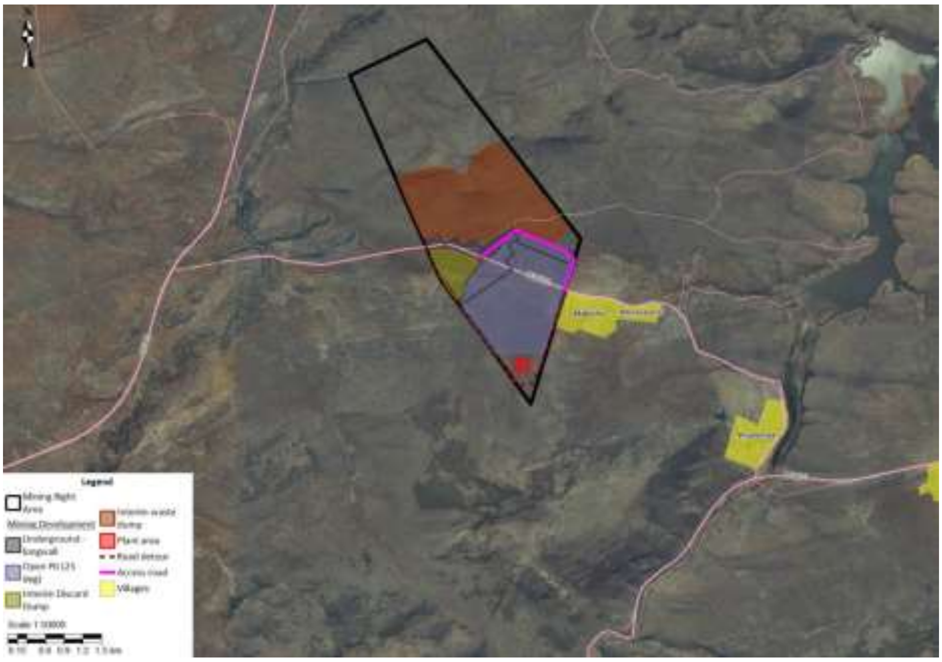


Figure 1: Proposed scoping layout of planned The Duel Coal Project

1.3 Full Impact Assessment's Objectives

SANS 10328:2008 "Methods for environmental noise impact assessments" document defines the scope of work to assist in completing a full impact assessment, below are some key aspects that make up a full impact assessment:

- To determine and describe the existing noise climate of the region where the development will take place;
- To identify all existing noise sources in the study region that potentially could have an impact on the noise levels;
- To identify all sensitive receptors and developments in the region;
- To list all the possible noise causing equipment and processes that could be introduced by the new development in the region. Also estimate the Sound Power Level of the different equipment and/or processes;
- To indicate and describe the different scenarios and processes under investigation;
- To present all assumptions made during this assessment;
- To assess the noise propagation per scenario over the region and to determine the difference in noise level;
- To rate the risk to the environment per scenario and/or operation activity;
- Conclude and recommend remedial measures or abatement technology that should be implemented, if found required; and
- To recommend future follow up investigations.

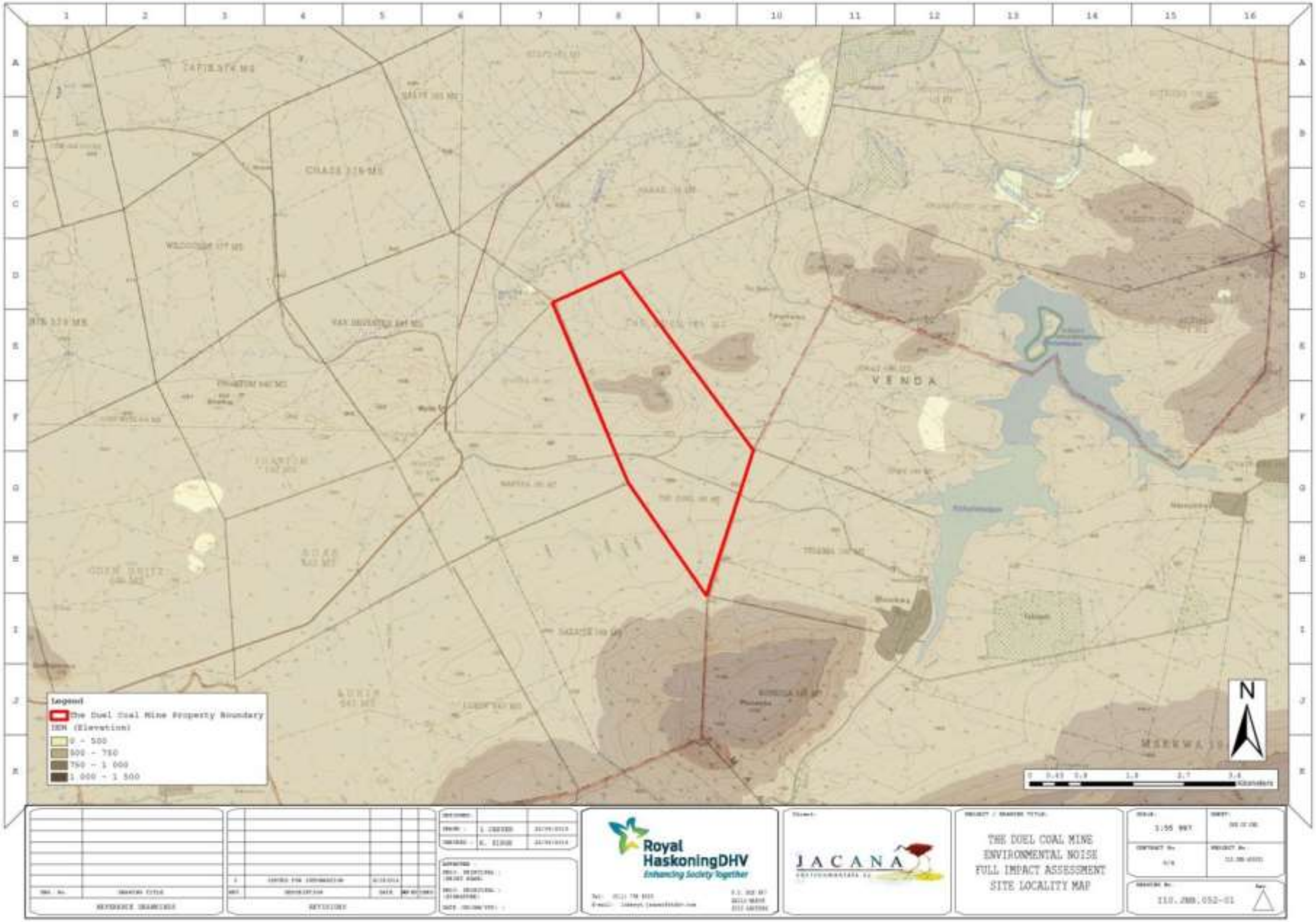


Figure 2: Locality map of the study area and mining location

2 Project Applicable Legislation

In South Africa the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) has been superseded by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). However, the "noise control" regulations (on which SABS 0328:2000 was based) that were promulgated under sections 25 and 28 of ECA, and published in Government Notice No. GR 896 of 27 April 1990, will stay in force for the time being. The National Noise Control Regulations were adopted in 1998 by the different provinces and falls within the new National Environmental Management Act. Thus any activities that could have a substantial detrimental effect on the environment are included in the whole of South Africa.

The SANS 10328 standard forms the basis on which noise impact investigations should be conducted as prescribed in regulations published under the ECA, NEMA and the Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA) or any other noise control regulations. In terms of the NEMA, an environmental impact study and assessment have to be conducted before a new development or upgrade of an existing activity can be approved by the relevant authority.

The environmental impact investigation has to:

- identify all the issues that could have an effect on the environment,
- assess the impact of the identified issues on the environment, and
- identify possible alternatives and assess their impact on the environment.

Noise is an issue that has a significant effect on the environment and its inhabitants' behaviour and should therefore form part of all environmental impact studies. However, contrary to most of the other environmental issues that are assessed subjectively, the assessment of the impact of noise on the environment can be done scientifically and objectively by following the procedures and methodology described in the SANS 10328 document (See Section 3). The reaction responses to noise on the other hand are subjective as each person can preserve noise in a different way.

The following subsection will discuss the different regulations that are relevant to this project and will conclude with a summarised table indicating the target noise levels.

2.1 Noise Control Regulations

As mentioned above, the National Noise Control regulations were promulgated in 1992, there after the provinces of South Africa adopted and instituted the provincial noise by-law.

In terms of Regulation 2 (d) of the Noise Control Regulations:

> *"A local authority may, before changes are made to existing facilities or existing use of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests be conducted to the satisfaction of the local authority by the owner, developer, tenant or occupant of the facilities, land or buildings and that reports or certificates relating to the noise impact be submitted to the local authority, to the satisfaction of the local authority, by owner, developer, tenant or occupant."*

In terms of Regulation 3 (c) of the Noise Control Regulations:

> *"No person shall make changes to existing facilities or existing use of land or buildings or erect new buildings, if these will house or cause activities that will, after such changes or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority."*

In terms of Regulation 4 of the Noise Control Regulations:

> *"No person shall make, reduce, or cause a disturbing noise, or allow it to be made, produced or cased by any person, animal, machine, devise or apparatus or any combination thereof."*

2.2 South African National Standards (SANS)

SANS 10103 should also be adhered to for the measurements of noise levels at specific locations. This document prescribes the methodology of how a noise investigation should be conducted and prescribes the selection of monitoring locations, placement of the microphone and specific equipment and calibration of the equipment.

The assessment of the noise levels is based on "Typical rating levels for noise in districts" (Table 1, below). These in/out-door noise level standards are not a standard as such, but are guidelines of typical noise values that can be experienced in the different regions of South Africa.

2.2.1 SANS 10103:2008

SANS 10103 should also be adhered to for the measurements of noise levels at specific locations. This document prescribes the methodology of how a noise investigation should be conducted and prescribes the selection of monitoring locations, placement of the microphone and specific equipment and calibration of the equipment. The calculations to accurately determine if a noise level from the field is compliant to the maximum allowed noise rating level, are presented in the document. A straight forward comparison of the LA_{eq} value is not equal to the LA_{Req}(rating level) which is listed in Table 1, below.

The project will follow the methodology set out in SANS 10328:2008 "*Methods for environmental nose impact assessments*". This SANS document prescribes the methodology to follow for the three main impacts assessment reporting stages, Screening, scoping and Full Impact Assessment. This project will be assessed as a full impact assessment as the size and type of project will require a conclusive investigation and accurate modelling. The method applied is discussed in section 3.

Table 1: Typical rating levels for noise in districts (adapted from SANS 10103:2008)

Type of District	Equivalent Continuous Rating level for Noise ($L_{Req,T}$) (dBA)					
	Outdoors			Indoors (with windows open)		
	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)
a) Rural	45	45	35	35	35	25
b) Suburban (with little road traffic)	50	50	40	40	40	30
c) Urban	55	55	45	45	45	35
d) Urban (with one or more of the following: workshops, business premises and main roads)	60	60	50	50	50	40
e) Central Business Districts	65	65	55	55	55	45
f) Industrial District	70	70	60	60	60	50

Table 2: Categories of community/group response (adapted from SANS 10103:2008)

Excess ($\Delta L_{Req,T}$)[a] dBA	Estimated Community/Group response	
	Category	Description
0 – 10	Little	Sporadic Complaints
5 – 15	Medium	Widespread Complaints
10 – 20	Strong	Threats of community/group action
>15	Very Strong	Vigorous community/group action

NOTE: Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.

a. $\Delta L_{Req,T}$ should be calculated from the appropriate of the following:
1) $L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residuel noise (determined in the absence of the specific noise under investigation);
2) $L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level of the ambient noise given in Table 1 of the code;
3) $L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from Table 2 of the code; or
4) $L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in the area because of the proposed development under investigation.

2.3 Summary of Target Noise Levels

It should be noted, that in the different guidelines and standards, listed above, the impact from noise could be calculated on different "type" of equations and formulas. In SANS 10328 the impact is derived from the change of the future noise levels and the typical rating noise level for the receptor (maximum permissible noise level as identified in Table 1). This type of impact can be described as the noise impact, however this excludes the baseline of the region that would impact on the cumulative noise levels.

The other "type" of calculation is based on the change in noise level estimated at the receptor (as found in Table 2). This calculates the change in noise level experienced by the receiver at a location. It binds with the theory of noise, which states, that any +3dBA change in noise level is a doubling of the noise sources. Thus it should be noted, that there are different categories from different institutions regarding this aspect of environmental noise.

A summary is presented in the table below (Table 4), summaries the environmental impact rating (regarding severity), as measured at the closest applicable receptor point. The outdoor (environmental) noise levels is the basis for calculation perceived at the receptors. It is noted that the majority of complaints arise from residents during the night, these types of complaints are more characteristic to indoor noise levels. If any of the receptors' night-time noise levels are excceded, a calculation of the perceived indoor noise will be done.

Based on the sites locality (in the rural areas of the Limpopo Province with a sparse population density) the typical noise level rating (also referred to as the maximum allowable noise level) for the study is classified as Rural to Sub-urban, unless specified other wise at receiver. It should be noted once the mine is in operation the land use zoning of the farm will be reclassified to Industrial within the boundaries of the mine area.

Table 3: Typical Rating Noise Level for this assessment

Equivalent continuous rating noise level (L_{Req})	Outdoor			Indoor		
	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)
(A) Sub-urban	50	50	40	40	40	30

Table 4: Environmental Impact Rating from the change in noise level

<table>
<tr><td>Δ +15 dBA</td><td rowspan="5">Strong Response
“Threats of Community Action”</td><td rowspan="12">Significant</td><td rowspan="9">Disturbing noise</td><td rowspan="5">Very High</td></tr>
<tr><td>Δ +14 dBA</td></tr>
<tr><td>Δ +13 dBA</td></tr>
<tr><td>Δ +12 dBA</td></tr>
<tr><td>Δ +11 dBA</td></tr>
<tr><td>Δ +10 dBA</td><td rowspan="5">Medium Response
“Widespread Complaints”</td><td rowspan="3">High</td></tr>
<tr><td>Δ +9 dBA</td></tr>
<tr><td>Δ +8 dBA</td></tr>
<tr><td>Δ +7 dBA</td><td rowspan="2">Medium</td></tr>
<tr><td>Δ +6 dBA</td><td rowspan="6">Not Disturbing</td></tr>
<tr><td>Δ +5 dBA</td><td rowspan="5">Little Response
“Sporadic complaints”</td><td rowspan="2">Low</td></tr>
<tr><td>Δ +4 dBA</td></tr>
<tr><td>Δ +3 dBA</td><td rowspan="3">Insignificant</td><td rowspan="3">Very Low</td></tr>
<tr><td>Δ +2 dBA</td></tr>
<tr><td>Δ +1 dBA</td></tr>
<tr><td>Change in Noise level</td><td>SANS 10103</td><td>WHO (IFC EHS Section 1.7)</td><td>***Disturbing noise (Noise Regulations)</td><td>Environmental Impact Rating (Severity)</td></tr>
</table>

** It should be noted that the WHO is only applicable to the closest receptor to the source, located offsite from the source.*
*** The environmental impact rating level will be used to determine the severity of the impact.*
**** it should be noted that this form of describing a noise as disturbing was removed from the majority of provincial noise regulation by-laws.*

3 Project Methodology

The general procedure to follow impact assessments regarding noise on the environment are outlined in SANS 10328:2008 "Methods for Environmental Noise Impact Assessment". As per agreement with the client, this report focuses on the full impact assessment (Section 8).The investigation will address the key points as listed in section 8.7, following additional procedures and protocol listed in SANS 10103 and the noise control regulations.

As the report follows upon the scoping report completed in November 2015, the methodology will focus on the following sub-categories.

- Determination of the sound emission from identified noise sources
- Determination of the expected rating level
- Determination of the desired rating level
- Determination of the noise impact
- Assessment of the noise impact
- Alternatives and mitigation measures

The following methods focuses on determining the existing sound power levels of all existing sound sources in the region and also to estimate the sound power levels of all equipment/activities/operations of the new development. These SWL will be used in the propagation model (CadnaA) to calculate the noise levels at each receptor point. Different mitigation measures can be investigated, if found required to reduce noise at identified receptors.

The noise impact assessment will include the following scenarios, as suggested by the scoping report:

- Scenario 01: Baseline (Existing Noise);
- Scenario 02: Construction Phase – Earth Clearing;
- Scenario 03: Construction Phase – Site Plant Assembly;
- Scenario 04: Operational Phase – Opencast Mining;
- Scenario 05: Operational Phase – Underground Mining;
- Scenario 06: Operational Phase – Mitigation Measures

3.1 Determination of sound emissions from identified sources

In determining the sound power levels of the existing and future noise sources, an in-depth investigation was conducted on all equipment used to assess their patter and cycle of operation, placement of sources, spectral character of each source and number of sources.

A full sound power level inventory is presented in Section 6, where each scenario's SWL inventory will be indicated.

3.2 Determination of the desired rating level

During the site visit to the Duel Coal mine Farm portion, long term daytime measurements were conducted at two locations, the results of these locations will be used to determine the desired rating level for the surrounding regions. The calculations will follow SANS 10357 and SANS 10103.

The desired rating levels will be presented in Table 6.

4 Existing Environment

The existing environment was determined in the scoping assessment. The following is strongly based on the information gathered from the scoping report.

4.1 Existing Noise Sources

The assessment only found two sources of noise in the study area that could be calculated and modelled in the propagation software. Other source such as wildlife, bird calls, insect noise, are excluded from this study.

4.1.1 Roads

Some of the roads in the region are:

- National Route 1 (N1) – The road travels from Louis Trichardt to Musina at the Zimbabwe border, the traffic consists out of a large number of trucks using the road and small vehicles;
- Unnamed Road 01 (N1 to Mudimeli Village) – gravel road linking the town of Mudimeli with the National road N1 towards the west. The road continuous north to connect with the R525; and
- Unnamed Road 02 (Mudimeli to Nzhelele Dam) – gravel road linking the town of Mudimeli to the Nzhelele dam, the road also connects to the DS 3671 tarred road, travelling south towards Makhado village.

4.2 Identified sensitive receptors

The map (Figure 3) indicates the sensitive areas, based on the information gathered from cadastral maps (2229DB, 2229DD, 2230CA and 2230CC), Google Earth and other Aerial Photography conducted in the past. It is noted that some of the information is old and that houses could have been constructed recently. The sensitive areas were established to the best available information at hand and experience gained during the site visit.

As the areas are spread out over the region, there for there are only a few sensitive areas located within 1.5km of The Duel property boundary. The table below present the relevant sensitive areas selected for further analysis, included in the table are monitoring points that were measured during the baseline assessment.

The expected and desired rating levels are also presented in the following table(s).

Table 5: Desired rating level based on long-term (24-hour) noise measurement

	Measure results (dBA)	SANS 10103 Table 2 Land-use Zone (dBA)		
		Rural	Sub-urban	Urban
$L_{Req,day}$	49.7	45	50	55
$L_{Req,night}$	42.7	35	40	45
$L_{Req,dn}$	50.5	45	50	55
Desired Rating Level	***Sub-Urban***	NO	YES	

Table 6: Identified receptor locations for further impact assessment

ID	Name	Description	Coordinates		Desired Rating Level ($L_{Req,dn}$) - dBA
			Latitude	Longitude	
SR_01	Southern Slope	Rural - Natural Environment	-22.750352	30.036057	50
SR_02	Northern Slope	Rural - Natural Environment	-22.739719	30.028655	50
SR_03	Fenceline 01	Rural - Natural Environment	-22.758274	30.029282	50
SR_04	Fenceline 02	Rural - Natural Environment	-22.775775	30.042961	50
SR_05	Fenceline 03	Rural - Natural Environment	-22.752736	30.050473	50
SR_06	Fenceline 04	Rural - Natural Environment	-22.724998	30.027281	50
SR_07	Fenceline 05	Rural - Natural Environment	-22.730042	30.015767	50
SR_08	Offsite 01	Rural - Natural Environment - Farm boundary road	-22.724071	30.007553	50
SR_09	Offsite 02	Rural - Farmstead	-22.714501	30.014692	50
SR_10	Offsite 03	Rural - Farmstead	-22.747115	29.99718	50
SR_11	Offsite 04	Rural - Watering hole	-22.743252	29.993268	50
SR_12	Offsite 05	Sub-urban - School	-22.777887	30.076465	50
SR_13	Offsite 06	Rural - Farmstead	-22.759402	30.059609	50
SR_14	Offsite 07	Makushu Receiver 01	-22.761596	30.053484	50
SR_15	Offsite 08	Makushu Receiver 02	-22.761064	30.049141	50

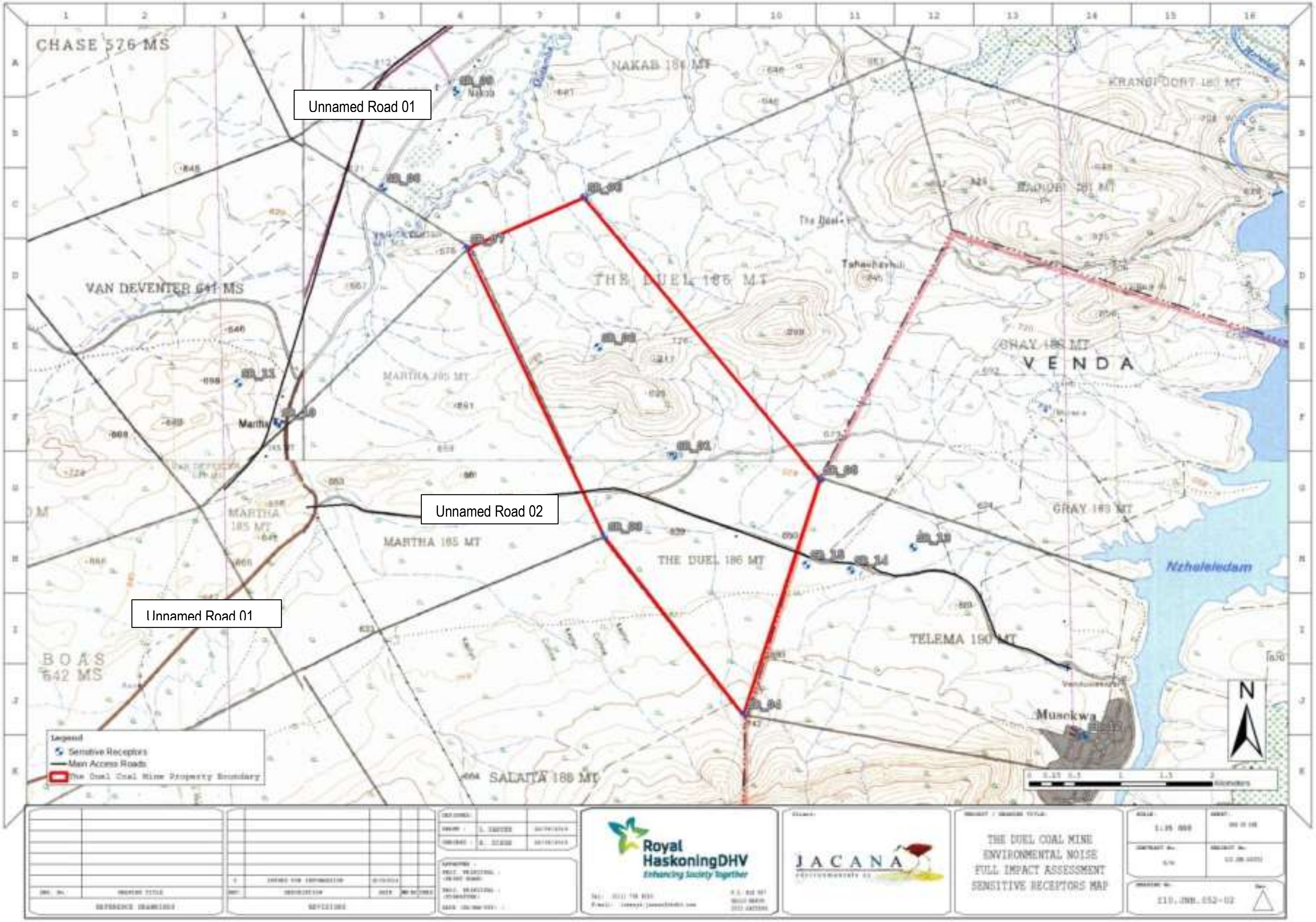


Figure 3: Map illustrating the locations of the identified receptors to be used in the full impact assessment

4.3 Meteorological Conditions (Specific to the Region)

The northern part of the Limpopo Province is situated in a dry savannah sub region, characterized by open grasslands with scattered trees and bushes. The Soutpansberg mountain range is a major regional topographic feature and it extends in an east-west direction for a distance of approximately 130 km. The regional climate is strongly influenced by the east-west orientated mountain range which represents an effective barrier between the south- easterly maritime climate influences from the Indian Ocean and the continental climate influences (predominantly the Inter-Tropical Convergence Zone and the Congo Air Mass) coming from the north.

The region is characterized by Warm Temperate to Arid Climate conditions as classified by the 2012 CSIR Köppen-Geiger map for South Africa (Conradie and Kumirai, 2012).The climate for the region varies from warm summers with dry winters in the south and in close proximity to the Soutpansberg Mountains to Hot Semi-Arid and Arid conditions north of the mountains. The data was sourced from the South African Weather Seerivises (Station Thohoyandou Wo - 0723664 6).

The daily summer average temperature is in the region of 23°C - 24°C, with the winter daily temperatures ranging between 13°C - 15°C. The humidity of the region during the summer is the highest with a daily average of 75% and the winter dipping down to 70% - 72%. The average rainfall per year during 2008 to 2012 is estimated to be in the range of 175mm to 215mm per year.

The predominant wind direction for the area under review is mainly from the south eastern region. Secondary winds occurred mainly from the eastern region and calm wind conditions (<0.5 m/s) were experienced 0.1 % of the time. The most frequent wind speed of 0.5-2.1 m/s occurred for 40.7% of the time. Wind speeds between 2.1 -3.6 m/s were experienced 34.6% of the time, while wind speeds between 3.6 -5.7 m/s was experienced 22.9% of the time. High wind speeds of 5.7 -8.8 m/s occurred less frequently at 1.7% of the time. (see Figure 5)

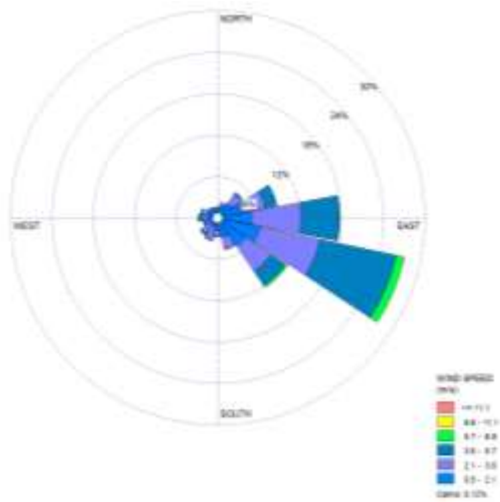


Figure 4: Wind rose from January 2008 to December 2012

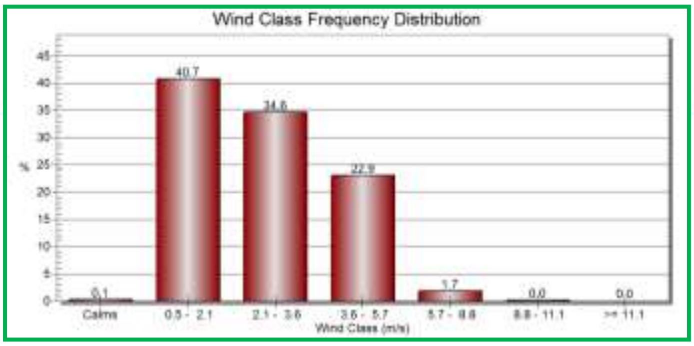


Figure 5: Wind frequency profile per wind speed (m/s) - January 2008 to December 2012

Atmospheric stability is commonly categorised into one of seven stability classes. These are briefly described below. The atmospheric boundary layer is usually unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5-6 hours after sunrise. The degree of thermal turbulence is increased on clear warm days with light winds. During the night a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral. A neutral atmospheric potential neither enhances nor inhibits mechanical turbulences. An unstable atmospheric condition enhances turbulence, whereas a Stable atmospheric condition inhibits mechanical turbulence.

Table 7: Atmospheric stability class

A	Very unstable	calm wind, clear skies, hot daytime conditions
B	Moderately unstable	clear skies, daytime conditions
C	Slightly Unstable	moderate wind, slightly overcast daytime conditions
D	Neutral	high winds or cloudy days and nights
E	Slightly Stable	moderate wind, slightly overcast night-time conditions
F	Moderately stable	low winds, clear skies, cold night-time conditions
G	Very stable	Calm winds, clear skies, cold clear night-time conditions

The site experienced mostly moderately stable atmospheric conditions (31.1%) which are characteristic of low winds, clear skies and cold night time conditions. 17.5% of the time was attributed to moderately unstable atmospheric condition which are characteristic of clear skies.

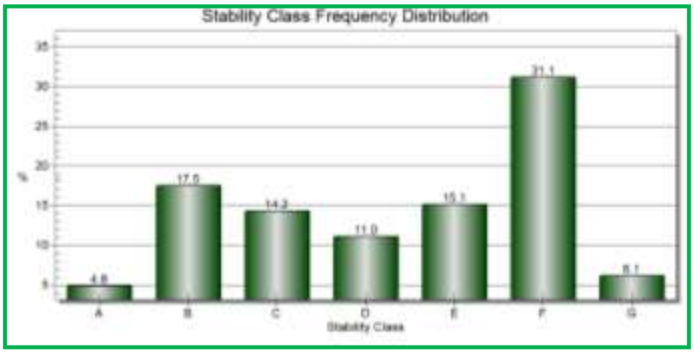


Figure 6: Stability Class Frequency Distribution – Jan 2008 to December 2012

5 Propagation Model Data Input & Assumptions

This section goes in detail regarding the input parameters used to setup the sound propagation modelling software. The input required ranges from terrain, calculation area, meteorological, SWL, etc.

The future estimation of noise levels in the region will be calculated by the approved international modelling software called CadnaA, the environmental noise modelling software used by Royale HaskoningDHV (South Africa). The software is an international leading package for calculation, presentation, assessment and prediction of environmental noise. The CadnaA software is designed to handle all types and sizes of projects; determining the noise from an industrial plant, a parking lot, noise emanation from buildings, a new road or railway network and entire towns and urbanized areas. The software is designed with more than 30 international standards and guidelines (with the option to add local standards and guidelines), powerful calculation algorithms, extensive tools for object handling and an outstanding 3D visualization tool. The CadnaA software can communicate with other Windows applications like word processors, spreadsheet calculators, CAD software and GIS-databases. The data that will be entered into the model are, but not limited to the following:

- Topography;
- Meteorological conditions;
- Roads;
- Buildings;
- Noise point sources;
- Line noise sources (HP pipes, etc.); and
- Area sources, like construction activities (horizontal and vertical).

5.1 Project Study Area

As mentioned before the study area falls over four topographical grids called (2229DB, 2229DD, 2230CA and 2230CC), the contour height lines of each was merged and one final contour line file was created and clipped to the project area boundaries. The contour lines were then imported into CadnaA to set the base heights for the model. The project area is larger than the calculation area, to ensure all aspects of terrain formations are included in the modelling calculations. The table below indicate the SW and NE corner coordinates of the project area and calculation area.

Table 8: Project and Calculation Area coordinates

		Latitude	Longitude	X-coordinate (UTM 35S) - meters	X-coordinate (UTM 35S) - meters	Area Size (km^2)
Project Area	SW	-22.803886	29.988187	806772.58	7475087.32	110.95
	NE	-22.701551	30.073654	815788.05	7486246.79	
Study/Calculation Area	SW	-22.799284	29.992954	807272.58	7475587.32	90.77
	NE	-22.696947	30.078414	816288.05	7486746.79	

5.2 Configuration

In SANS 10328 and SANS 10103 it is stated that the SANS 10357 (CONCAWE method) and SANS 10210 (Calculation of Road Traffic Noise) must be used to assess the propagation of sound for the purpose of impact assessments. The CadnaA modelling software has a list of international calculation methods, from this the CONCAWE was selected for industrial purposes (normal propagation method from source to receiver) and CRTN for road calculations. The CRTN is a Welsh and UK preferred method, on which the SANS 10210 is strongly based. No specific method was chosen for railway noise as there is no railway within the project plan.

Each of the calculation methods has special options to select to ensure the method of calculation is done in the correct way and is acceptable on the project. The one option of different time intervals used to calculate, refers to the day/night time frames and excluded evening hours in a day. Thus the daytime (06:00 – 22:00) has 16 hours and night-time (22:00 – 06:00) has 8 hours (16/0/8).

The whole of the evening was also excluded from calculations and no hours of operation was specified for this period during a day. If activities are only operational for a set period of time during the day and/or night, it will be specified within the source.

The model was programed to calculate the Day-, Night and Day/Night rating levels (dBA) in octave band frequencies and single band. The results will be calculated per receiver and can be directly evaluated against the SANS 10103 maximum allowable rating levels. The results (iso-decibel lines and table format) will be exported for further analysis and investigation. The calculation grid was setup with a 10m x 10m spacing and a height above ground level of 1.5m.

5.3 Metrological Data

The meteorological parameters required for the use in this study are: Temperature, Humidity, Wind Speed, Wind Direction and Atmospheric Stability Class.

The meteorological data discussed in Section 4.3 covered the records from 2009 to 2012. The meteorological settings built in provide limited options for Temperature and Humidity. The average data will be used in the model, equating to an annual average for the parameters.

Table 9: Meteorological Input data

Parameter	Daytime (06:00 – 22:00	Evening (n/a)	Night (22:00 – 06:00)
Temperature			
- *Average*	22.0	---	15.8
- *Maximum*	39.6	---	27.4
- *Minimum*	5.4	---	1.8
- *Model input (CadnaA)*	20.0	---	15.0
Humidity			
- *Average*	66.9	---	84.2
- *Maximum*	98.0	---	99.0
- *Minimum*	12.0	---	16.0
- *Model input (CadnaA)*	65.0	---	85.0
Wind Profile			
- *Atmospheric Stability Class*	B	---	F
- *Wind Speed*	2.75	---	2.59
- *Wind direction*	90.0	---	132.1

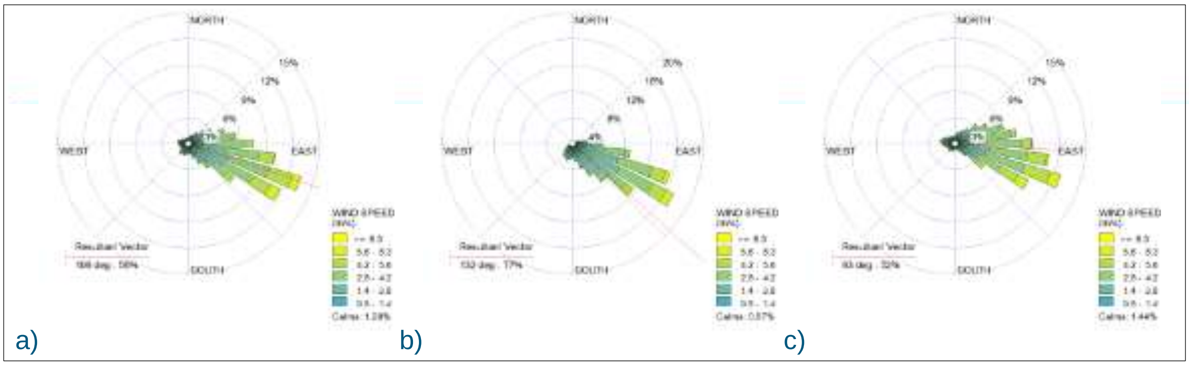


Figure 7: Windroses from 2009-2012 data (a)Annual, b) Night-time and c) Daytime)

5.4 Variant (Scenarios)

Within CadnaA all objects are organized in groups to assign the correct objects (sources, buildings, receptors, grids, etc.) to the associated scenario (variant).

The following list of scenarios are defined and will be calculated in the model.

Table 10: Variant names description used in CadnaA

Short Name	Variant (Scenario) Name
BL	Baseline
CEC	Construction – Earth Clearing
CPA	Construction – Plant Assembly
OOM01	Operational – Opencast Mining
OOM12	Operational – Underground Mining
OOM24	Operational – Traffic and Waste dump
MIT	Mitigated Scenario

6 Sound Power Level Inventory (SWL)

6.1 Scenario 01 – Baseline (Existing Noise)

This scenario focuses on determining the existing baseline noise levels at all receptors identified and measured during the site visit. The measurement done during the site assessment will be used to calibrate the model and to discuss the existing soundscape of the region and site. The identified noise sources of the region were identified and basic measurements and observations were made to ensure the baseline conditions of the region are as accurate as it can be. It should be noted that the background noise can not solely be described to the identified and listed sources as the ambient noise is impacted by an accumulation of different noise sources. The list of applicable sensitive receptors will be presented at the end of this SWL inventory.

Table 11: Summary Sound Power Level Inventory – Scenario 01

SRC_CODE	NAME	SOURCE TYPE	SWL (dBA)	DURATION (min)	
				Day (06:00 - 22:00)	Night (22:00 – 06:00)
BL_SAR	Site Access Road	Road	D: 55.1 & N: 48.3	n/a	n/a
BL_NAR	N1 Access Road	Road	D: 54.5 & N: 48.8	n/a	n/a
BL_PPR	Provincial Paved Road	Road	D: 56.9 & N: 54.8	n/a	n/a

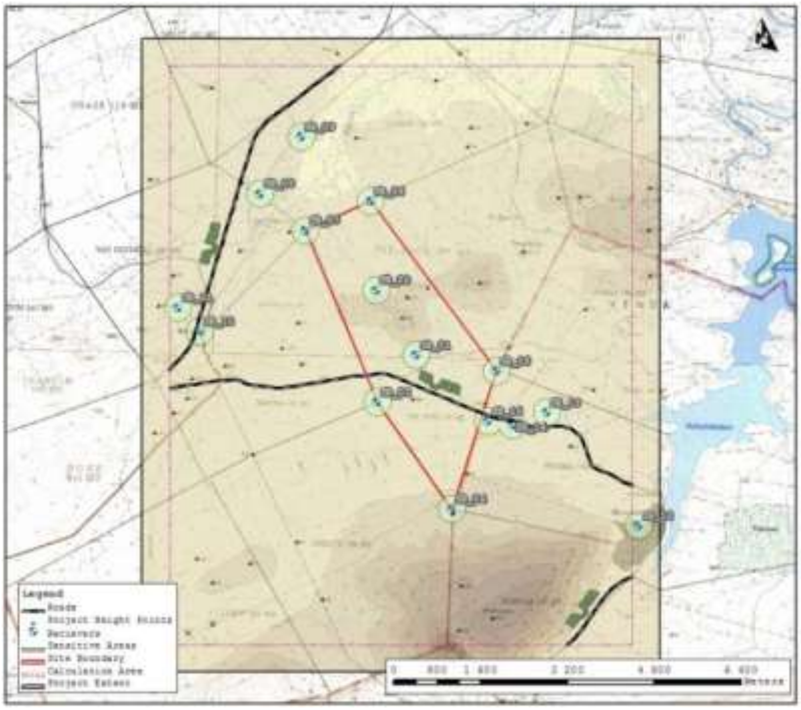


Figure 8: Scenario 01 – Illustration of sources relative to site boundary

6.2 Scenario 02 – Construction – Earth Moving

Description: The construction phase of the project is divided into two different stages called the Earth Moving (including construction camp construction) stage and the Site Plant Assembly (including opencast pit establishment). This section of the SWL inventory will focus on the earth moving stage, which consist out of levelling of the earth surface, cut and back fill, initial road constructions to the plant site and the pit areas. The associated noise sources with this stage of construction are typically mobile large machinery, bulldozers, earth scrapers, staff transportation busses, mobile generators, etc.

Noise Sources: The type of noise is very complex in the sense that not all of the noise sources will be active all at the same time and also the same duration of time. The model will attempt to incorporate the duration of noise sources in the scenario to increase the accuracy of the modelled results. The summary of active noise sources (Table 12) for this scenario indicated below include their relevant Sound Power Level and duration time of activity. This scenario will only focus on noise emanating from the activities and will exclude the baseline conditions (the cumulative impact is addressed later on).

Table 12: Summary Sound Power Level Inventory – Scenario 02

SRC_CODE	NAME	SOURCE TYPE	SWL (dBA)	DURATION (min)	
				Day (06:00 -22:00)	Night (22:00 – 06:00)
CEC_CV	Construction Village	Area	95.5	420	60
CEC_OPC	Opencast Pit	Area	113.2	480	0
CEC_PPA	Plant & Pit Area	Area	92.1	480	0
CEC_V-S	Village to Site	Road	D: 40.1 & N:35.5	n/a*	n/a*
CEC_ACR	Access Road	Road	D: 41.2 & N: 0	n/a*	n/a*

*Road sources is dependant on the number of vehicles passing per hour, this is presented in the detailed Sound Power Level Inventory (Appendix A)

Physical Parameter: The terrain used in assessing this scenario is similar to the existing DEM. No cut and fill activities are completed during this assessment. The meteorological parameters are and will stay the same as used in the existing environment (see Section 5.3).

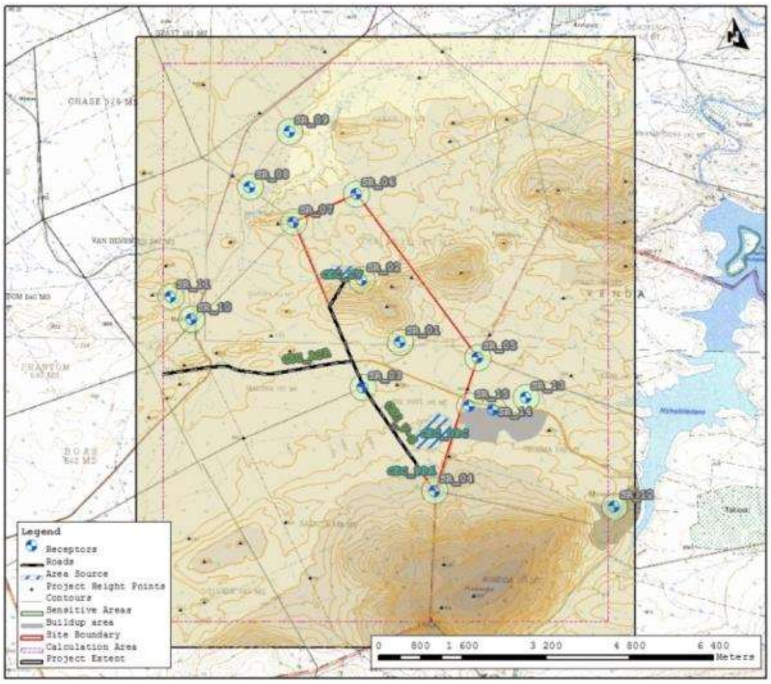


Figure 9: Scenario 02 – Illustration of sources relative to site boundary

6.3 Scenario 03 – Construction – Site Plant Assembly

Description: This scenario will focus on the construction activities associated in assembling the process plant. Similar to the previous scenario the noise emitted during this scenario is difficult to exactly determine and the activities will be limited to daytime timeframes only. As the mining pit area was cleared in the previous modelling scenario, the pit will be excluded from this scenario. The road from the construction village to the site will also be excluded, as this was addressed in the previous scenario.

Noise Sources: The construction noise emanating from the plant are will be limited to the region where the plant infrastructure will be build. As the construction is subject to more stationary and high impulsive sources of noise the noise emanating from the plant sites will be combined into a general noise level of the area. The list of equipment foreseen active are listed in the table below, the last line indicate the final sound power level used for the different equipment types.

Table 13: Summary Sound Power Level Inventory – Scenario 03

SRC_CODE	NAME	SOURCE TYPE	NUMBER OF UNITS	SWL (dBA)
CPA_PPA	Scraper	Mobile	3	90
	Bulldozer	Mobile	4	95
	Front-end loader	Mobile	2	88
	Roller	Mobile	3	98
	Vibration-Roller	Mobile	2	105
	Transport Truck	Mobile	4	92
	Transport Truck	Mobile	4	92
	Crane	Stationary	2	98
	Generator	Stationary	8	100
	Compressor	Stationary	5	100
	Metal workers	Stationary	6	95

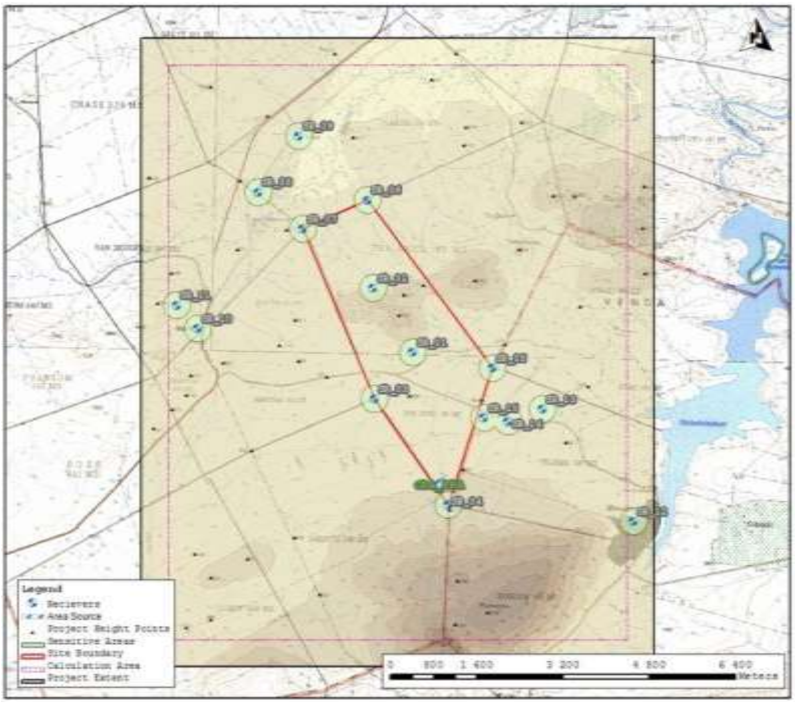


Figure 10: Scenario 03 – Illustration of sources relative to site boundary

Physical Parameter: The terrain used in assessing this scenario is similar to the existing DEM. No cut and fill activities are completed during this assessment. The meteorological parameters are and will stay the same as used in the existing environment (see Section 5.3).

6.4 Scenario 04 – Operational – Opencast Mining

Description: This scenario (scenario 04) focus on determining the noise emanating from the opencast mine operations. The process involved the active mining of ROM, transportation of ROM to plant are for crushing and screening. At the plant area the ROM will be crashed and screened into different sizes, the product (different sizes and quality of coal) will be stockpiled. All waste rock will be transported to the allocated waste rock dump. The model will determine the noise emanating from the opencast pit mine area (size and depth equal to 1 year active mining) and will include the waste rock dump as this could potentially influence the propagation of noise in the area. It should be noted that the Opencast pit area will cross over the existing road, thus from this scenario and onwards the altered route will be used for the baseline assessment.

Table 14: Summary Sound Power Level Inventory – Scenario 04

SRC_CODE	NAME	SOURCE TYPE	NUMBER OF UNITS	SWL (dBA)
OOM_OPY1 & OPY12	Opencast pit	Area	1	123.9
OOM_MHA	Material handling	Area	4	112.8
OOM_CONV	Conveyor system	Area	2	91.7
OOM_CSP	Crushing & screening plant	Area	1	96.5
OOM_R-S	Road to Site	Road	1	47.2
OOM_SP-R	Product stockpile loading	Road	1	47.3
OOM_PP	Pit to plant	Road	1	47.3
OOM_A-S	Road	Road	1	43.6

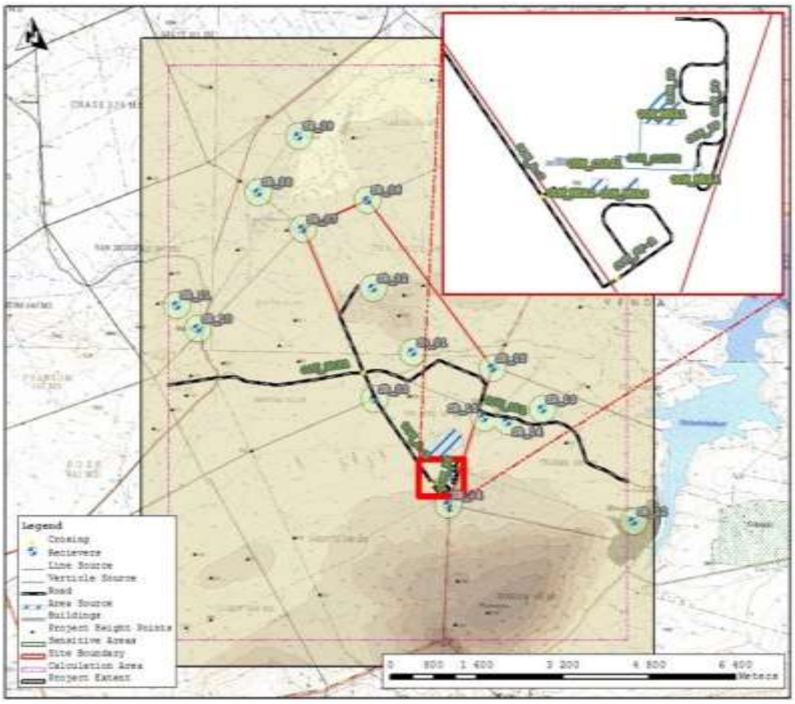


Figure 11: Scenario 04 – Illustration of sources relative to site boundary

Noise Sources: The noise source identified for this scenario are the active ROM handling in the pit area, transport (via haul trucks) to the plant area, dumping of material at Plant area, conveying of ROM to crushing and screening, transport and storage of waste rock and transport of product. The model will illustrate the noise profile over the change of terrain from year 1 to year 12. All roads indicate the additional load of vehicles on the road and do not represent the cumulative noise emitted from the roads.

Physical Parameters: As the opencast mining is active during this scenario, the life of mine from year 1 and year 12 is illustrated, thus the terrain (opencast pit and waste rock dump) will be implemented. The meteorological conditions will also stay the same as per previous scenarios. The opencast pit area from Year 1 and Year 12 will change in location but not in sound power.

6.5 Scenario 05 – Operational – Underground Mining

The underground mining phase will commence after ten years of open cast mining. The coal seam will be accessed through long wall mining method, all the ROM will be transported via trucks out of the pit to the material handling area. The scenario focuses on indicating and calculating the effects of heavy transport vehicles and mining activities during the underground mining phase. The opencast mining impacted the terrain and the opencast pit size of year 10-14 was used to illustrate and calculate the noise emanation from operations. The above ground plant was still active and modelled to run at full capacity.

The noise sources associated with this scenario is the underground mining, transport of material to surface and processing of ROM. The roads will stay similar to previous scenarios. This scenario only excludes the opencast pit mining operations.

The physical environment changes in the pit as the whole pit is mined and long wall mining commences. The road into the pit extends to the wall face located on the northern section of the mine. The meteorological conditions are similar as per the previous scenarios.

Table 15: Summary Sound Power Level Inventory – Scenario 05

SRC_CODE	NAME	SOURCE TYPE	NUMBER OF UNITS	SWL (dBA)
OUM_MHA	Material handling	Area	4	112.8
OUM_CONV	Conveyor system	Area	2	91.7
OUM_CSP	Crushing & screening plant	Area	1	96.5
OUM_R-S	Road to Site	Road	1	47.2
OUM_SP-R	Product stockpile loading	Road	1	47.3
OUM_PP	Pit to plant	Road	1	47.3
OUM_A-S	Road	Road	1	43.6

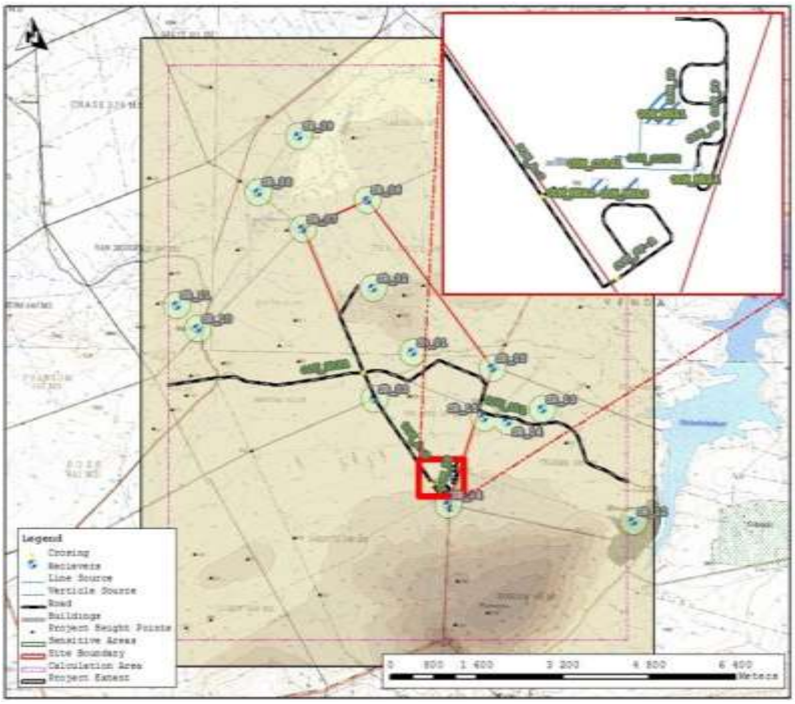


Figure 12: Scenario 05 – Illustration of sources relative to site boundary

6.6 Scenario 06 – Operational Mitigation Measures

The mitigation scenario is based on the different operational stages of the mining scenarios, which registered the highest increases in noise level at the three chosen locations, focussing primarily on the closest receiver SR_15.

With investigation of the sources of noise contributing to the noise level at the receiver it was found that the majority of the noise is generated at the mine processing plant. The available mitigation measures suggested are:

- Housing and/or screening of the processing plant (crushing and screening);
- Housing and/or screening of the conveyor systems;
- Minimizing noise at the material handling areas; and
- Erecting a noise barrier wall (2.5m in height) along the mine boundary, between the mine and receivers.

The mitigation applied, theoretically reduces the noise levels up to 90% and thus, 80% reduction of noise was applied at the site plant area. These sources located at the plant can be mitigated and the mining activities in the pit are more difficult to reduce existing noise levels.

7 Results

The following section present the results calculated at the sensitive receptors based on the corrected calculated baseline sound levels calculated in the baseline scenario (see Table 16). The noise level results calculated are based on the additional noise sources in the region and must be added to the baseline noise level to determine the cumulative noise level. This noise level will be evaluated against the sub-urban land use maximum allowable noise rating level and the increase in noise level will be indicated. Please not the closest sensitive receptor of a residential property/community is SR_13, SR_14 and SR_15 and specific attention will be provided to these receptors.

Table 16: Baseline Noise Level Results

ID	Name	Description	Model Calculated Baseline (dBA)			Corrected Baseline Noise Level (dBA)		
			$L_{Req,d}$	$L_{Req,n}$	$L_{Req,dn}$	$L_{Req,d}$	$L_{Req,n}$	$L_{Req,dn}$
SR_01	Southern Slope	Rural - Natural Environment	*26.7*	*19.9*	*28*	28.6	21.6	29.3
SR_02	Northern Slope	Rural - Natural Environment	*19.2*	*13.5*	*21.1*	21.1	15.2	22.4
SR_03	Fenceline 01	Rural - Natural Environment	*33*	*26.2*	*34.3*	34.9	27.9	35.6
SR_04	Fenceline 02	Rural - Natural Environment	*25.9*	*19.1*	*27.2*	27.8	20.8	28.5
SR_05	Fenceline 03	Rural - Natural Environment	*29.6*	*22.8*	*30.9*	31.5	24.5	32.2
SR_06	Fenceline 04	Rural - Natural Environment	*21.8*	*16*	*23.7*	23.7	17.7	25
SR_07	Fenceline 05	Rural - Natural Environment	*21.7*	*15.8*	*23.5*	23.6	17.5	24.8
SR_08	Offsite 01	Rural - Natural Environment	*26.6*	*20.8*	*28.5*	28.5	22.5	29.8
SR_09	Offsite 02	Rural - Farmstead	*30.4*	*24.6*	*32.3*	32.3	26.3	33.6
SR_10	Offsite 03	Rural - Farmstead	*40.7*	*34.9*	*42.6*	42.6	36.6	43.9
SR_11	Offsite 04	Rural - Watering hole	*32.1*	*26.2*	*33.9*	34	27.9	35.2
SR_12	Offsite 05	Sub-urban - School	*20.8*	*16.8*	*23.8*	22.7	18.5	25.1
SR_13	Offsite 06	Rural - Farmstead	*34.6*	*27.8*	*36*	36.5	29.5	37.3
SR_14	Offsite 07	Sub-urban - Community	*41.1*	*34.3*	*42.4*	43	36	43.7
SR_15	Offsite 08	Sub-urban - Community	*41*	*34.2*	*42.3*	42.9	35.9	43.6

The table and graph below present the measured summary octave band profile of the 24-hour measurement conducted during the site visit. The noise recorded is typical of the natural and existing noise profile. The area of the recording is classified as rural.

Table 17: Octave band – long-term results summary – Z-Weighted (dB)

	16 Hz	32 Hz	64 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 k Hz
Day/Night	67.3	64.5	58.8	49.8	44.4	41.2	39.3	36.8	37.4	32.3	28.1
Day	65.1	49.3	43.5	34.4	28.9	25.8	23.8	21.3	22.0	17.1	13.0
Night	43.3	33.8	34.2	26.4	22.3	18.3	16.8	15.2	14.7	4.2	-0.4

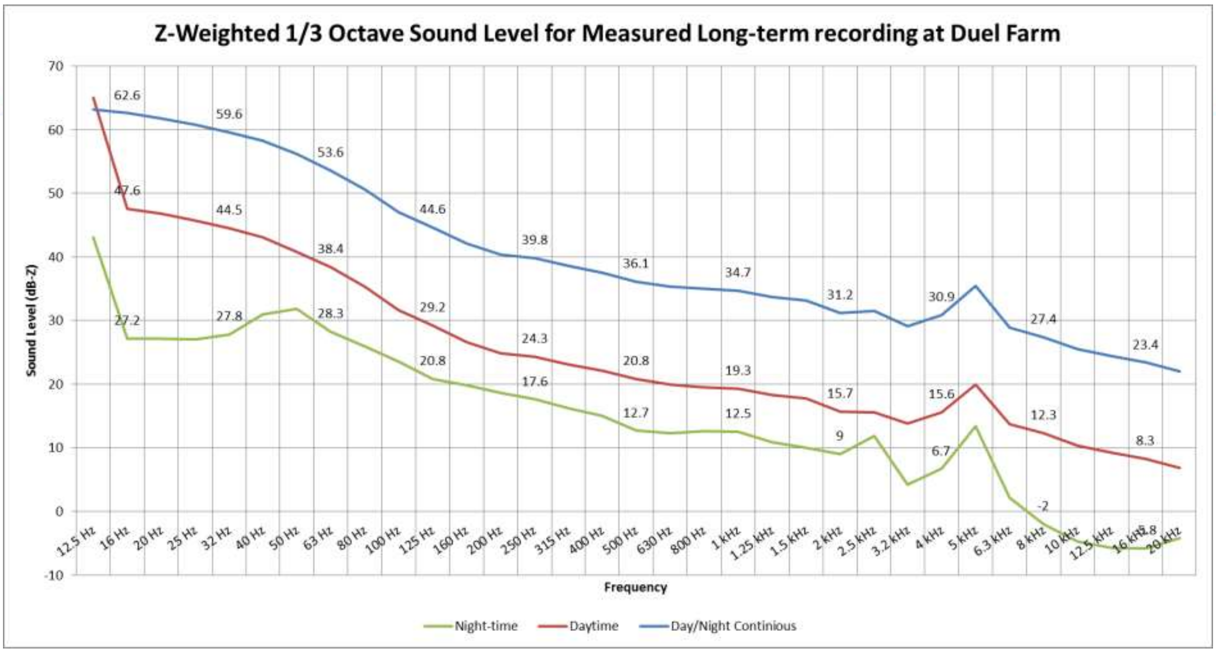
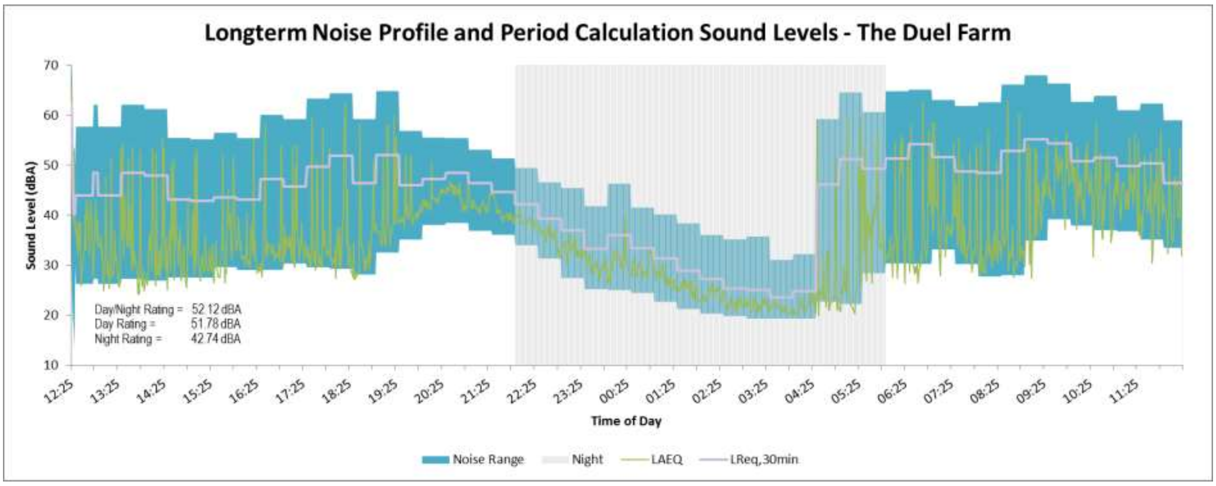


Figure 13: Baseline Octave Graph



7.1 Scenario 02–Construction Phase – Earth Clearing

In the table below are the results based on the modelled calculations for the Construction phase – earth clearing and construction camp establishment. The noise impact is significant high at receivers located, either very close to or on top of sources which were not there before (refer to SR_01 to SR_SR_05 and SR_07). The three receivers located close to existing residential locations are highlighted in bold (SR_13 to SR_15).

Table 18: Scenario 02 – Sensitive Receptor Results Summary

CODE ID	Modelled Scenario Results			Cumulative Noise Levels			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
SR_01	31.00	10.40	29.40	32.97	21.92	32.36	4.37	0.32	3.06
SR_02	43.10	40.00	46.70	43.13	40.01	46.72	22.03	24.81	24.32
SR_03	39.70	33.80	41.60	40.94	34.79	42.57	6.04	6.89	6.97
SR_04	35.90	13.70	34.30	36.53	21.57	35.31	8.73	0.77	6.81
SR_05	29.30	8.20	27.70	33.55	24.60	33.52	2.05	0.10	1.32
SR_06	20.60	21.40	27.30	25.43	22.94	29.31	1.73	5.24	4.31
SR_07	32.40	30.50	36.90	32.94	30.71	37.16	9.34	13.21	12.36
SR_08	16.40	13.30	20.00	28.76	22.99	30.23	0.26	0.49	0.43
SR_09	22.30	22.20	28.20	32.71	27.73	34.70	0.41	1.43	1.10
SR_10	21.50	15.80	23.50	42.63	36.64	43.94	0.03	0.04	0.04
SR_11	22.60	17.40	24.80	34.30	28.27	35.58	0.30	0.37	0.38
SR_12	8.10	-17.80	6.40	20.55	13.80	21.44	0.25	0.00	0.14
SR_13	**24.40**	**2.70**	**22.80**	**36.76**	**29.51**	**37.45**	**0.26**	**0.01**	**0.15**
SR_14	**29.20**	**6.00**	**27.60**	**43.18**	**36.00**	**43.81**	**0.18**	**0.00**	**0.11**
SR_15	**34.10**	**8.70**	**32.40**	**43.44**	**35.91**	**43.92**	**0.54**	**0.01**	**0.32**

No mitigation is required during this phase of the project.

7.2 Scenario 03 – Construction Phase – Plant Assembly

In the table below are the results based on the modelled calculations for the Construction phase – plant assembly. The noise impact is significant high at receivers located, either very close to, or on top of sources, which were not there before (refer to SR_01 and SR_03 to SR_05). The three receivers located close to existing residential locations are highlighted in bold (SR_13 to SR_15).

Table 19: Scenario 03 – Sensitive Receptor Results Summary

CODE ID	Modelled Scenario Results			Cumulative Noise Levels			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
SR_01	38.5	0.00	36.7	38.92	21.60	37.43	10.32	0.00	8.13
SR_02	11.7	0.00	10	21.57	15.20	22.64	0.47	0.00	0.24
SR_03	42.1	0.00	40.3	42.86	27.90	41.57	7.96	0.00	5.97
SR_04	49.1	0.00	47.4	49.13	20.80	47.46	21.33	0.00	18.96
SR_05	37.3	0.00	35.5	38.31	24.50	37.17	6.81	0.00	4.97
SR_06	0.00	0.00	0.00	23.70	17.70	25.00	0.00	0.00	0.00
SR_07	0.00	0.00	0.00	23.60	17.50	24.80	0.00	0.00	0.00
SR_08	0.00	0.00	0.00	28.50	22.50	29.80	0.00	0.00	0.00
SR_09	0.00	0.00	0.00	32.30	26.30	33.60	0.00	0.00	0.00
SR_10	0.00	0.00	0.00	42.60	36.60	43.90	0.00	0.00	0.00
SR_11	0.00	0.00	0.00	34.00	27.90	35.20	0.00	0.00	0.00
SR_12	17.8	0.00	16	22.24	13.80	22.42	1.94	0.00	1.12
SR_13	**31**	**0.00**	**29.3**	**37.58**	**29.50**	**37.94**	**1.08**	**0.00**	**0.64**
SR_14	**35.4**	**0.00**	**33.6**	**43.70**	**36.00**	**44.10**	**0.70**	**0.00**	**0.40**
SR_15	**40.4**	**0.00**	**38.6**	**44.84**	**35.90**	**44.79**	**1.94**	**0.00**	**1.19**

No mitigation is required during this phase of the project.

7.3 Scenario 04 – Operational Phase – Opencast Mining

In the table below are the results based on the modelled calculations for the first year of operations. The noise impact is significant high at receivers located, either very close to, or on top of sources, which were not there before (refer to SR_02 to SR_04). The three receivers located close to existing residential locations are highlighted in bold (SR_13 to SR_15).

Table 20: Scenario 04(Y1) – Sensitive Receptor Results Summary

CODE ID	Modelled Scenario Results			Cumulative Noise Levels			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
SR_01	27.1	16.7	27	34.27	38.10	43.66	+5.67	+16.50	+14.36
SR_02	23.8	12.3	23.4	25.67	17.87	26.34	+4.57	+2.67	+3.94
SR_03	43.1	31.6	42.7	43.97	37.33	45.29	+9.07	+9.43	+9.69
SR_04	42.5	26.1	41.2	51.92	53.30	59.10	+24.12	+32.50	+30.60
SR_05	26.8	16.7	26.8	33.95	36.11	41.80	+2.45	+11.61	+9.60
SR_06	16	4.5	15.5	24.38	18.11	25.59	+0.68	+0.41	+0.59
SR_07	16.8	5.3	16.4	24.44	18.13	25.61	+0.84	+0.63	+0.81
SR_08	8.8	-2.3	8.5	28.55	22.51	29.83	+0.05	+0.01	+0.03
SR_09	9.3	-2	8.9	32.32	26.31	33.61	+0.02	+0.01	+0.01
SR_10	16.3	4.9	15.9	42.61	36.61	43.91	+0.01	+0.01	+0.01
SR_11	16.3	5.5	16	34.07	27.92	35.25	+0.07	+0.02	+0.05
SR_12	8.8	1.7	10	21.09	18.05	24.51	+0.79	+4.25	+3.21
SR_13	**21.8**	**14.4**	**22.9**	**36.90**	**34.81**	**41.07**	**+0.40**	**+5.31**	**+3.77**
SR_14	**29**	**21.2**	**29.9**	**43.39**	**40.90**	**47.18**	**+0.39**	**+4.90**	**+3.48**
SR_15	**34**	**21.4**	**33.3**	**43.96**	**43.69**	**49.64**	**+1.06**	**+7.79**	**+6.04**

Mitigation during this phase of the project is required and should be investigated to reduce the noise impact at receiver SR_15.

7.4 Scenario 05 – Operational Phase – Underground Mining

In the table below are the results based on the modelled calculations for the operations based on the situation forecasted at when the operations start the underground mining (the scenario included the open pit mine and waste rock dumps). The noise impact is significant high at receivers located, either very close to, or on top of sources, which were not there before (refer to SR_02 to SR_04). The three receivers located close to existing residential locations are highlighted in bold (SR_13 to SR_15).

Table 21: Scenario 04(Y12) – Sensitive Receptor Results Summary

CODE ID	Modelled Scenario Results			Cumulative Noise Levels			Difference in noise level based on baseline scenario		
	Day	Night	Day/Night	Day	Night	Day/Night	Day	Night	Day/Night
	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
SR_01	31.9	23.3	32.4	34.13	38.88	44.34	+5.53	+17.28	+15.04
SR_02	28.9	17.5	28.5	29.57	20.17	29.70	+8.47	+4.97	+7.30
SR_03	45.6	34.1	45.1	45.95	36.71	46.10	+11.05	+8.81	+10.50
SR_04	45.3	27.6	43.9	46.56	53.90	59.30	+18.76	+33.10	+30.80
SR_05	30.1	23	31.3	34.22	39.83	45.22	+2.72	+15.33	+13.02
SR_06	20.4	9.1	20	25.40	18.43	26.29	+1.70	+0.73	+1.29
SR_07	20.7	9.3	20.3	25.40	18.31	26.23	+1.80	+0.81	+1.43
SR_08	13.4	2.2	13	28.63	22.54	29.89	+0.13	+0.04	+0.09
SR_09	13.7	2.4	13.3	32.36	26.32	33.64	+0.06	+0.02	+0.04
SR_10	20.1	9.3	19.9	42.62	36.61	43.92	+0.02	+0.01	+0.02
SR_11	21.4	10.7	21.1	34.23	27.98	35.37	+0.23	+0.08	+0.17
SR_12	8.9	6.1	12.7	20.63	17.57	24.02	+0.33	+3.77	+2.72
SR_13	**23.2**	**18.9**	**26**	**36.72**	**35.03**	**41.18**	**+0.22**	**+5.53**	**+3.88**
SR_14	**31.5**	**26.2**	**33.7**	**43.32**	**41.17**	**47.35**	**+0.32**	**+5.17**	**+3.65**
SR_15	**34.1**	**25.6**	**34.7**	**43.55**	**43.69**	**49.57**	**+0.65**	**+7.79**	**+5.97**

Mitigation during this phase of the project is required and should be investigated to reduce the noise impact at receiver SR_15.

7.5 Scenario 06 – Mitigation Measures

In the previous sub-sections for the operational phase of the mine, it was identified that mitigation measures should be investigated. The following tables present, per phase of operation, the top three noise sources affecting the closest receiver (SR_15). If these sources can be mitigated, either at source or through the pathway, it should significantly reduce the noise received by the receiver. The effect of the mitigation on the receiver is presented in the tables (Table 22 & Table 23).

Table 22: Mitigation measures implemented on the highest three sources identified per operational scenario (Daytime)

	Phase of Project	1st Noise Source			2nd Noise Source			3rd Noise Source			No mitigation	Mitigated	
		ID	NAME	dBA	ID	NAME	dBA	ID	NAME	dBA	dBA	dBA	Δ dBA
OOM	Opencast Mining	OPY1	Opencast Mining	**34.4**	MHA1	Material handling	**23.9**	CONV2	Conveyor System	**22.3**	35.7	33.7	**-2.0**
OOM12	Opencast mining (before Underground mining)	OPY12	Opencast Mining	**31.4**	CONV2	Conveyor System	**27.3**	MHA1	Material handling	**24.2**	35.0	33.7	**-1.3**
OOM24	Underground mining	MHA4	Material Handling Area	**30.9**	PP	Pit Road	**25.1**	SARR	Site Access Road	**24.4**	34.9	34.7	**-0.2**

Table 23: Mitigation measures implemented on the highest three sources identified per operational scenario (Daytime)

	Phase of Project	1st Noise Source			2nd Noise Source			3rd Noise Source			No mitigation	Mitigated	
		ID	NAME	dBA	ID	NAME	dBA	ID	NAME	dBA	dBA	dBA	Δ dBA
OOM	Opencast Mining	OPY1	Opencast mining	**39**	MHA1	Material handling	**30.7**	CONV2	Conveyor system	**28.6**	41.9	31.6	**-10.3**
OOM12	Opencast mining (before Underground mining)	MHA1	Material handling	**41**	CONV2	Conveyor system	**33.5**	CONV1	Conveyor system	**33.2**	42.9	41.2	**-1.7**
OOM24	Underground mining	MHA4	Material handling	**37.3**	MHA1	Material handling	**30.3**	PP	Pit Road	**24.3**	48.3	38.7	**-9.6**

These calculations are solely based on the covering and housing of the conveyor systems and crushing and screening pant located at the plant area of the mine. The method is limiting the noise from the source. It is strongly also suggested that a noise barrier be erected on the eastern fenceline between the plant and the neighbouring community. This will address the pathway noise from source to receiver, the closer the noise barrier to the source the more efficient the reduction in noise will be. In addition to these measures operational activities can be scheduled that could potentially reduce the noise (also reducing the noise during specific periods).

8 Environmental Risk Rating

As mentioned earlier in the report, the severity/intensity is adjusted to the follow the impact associated and measurable of noise.

8.1 Construction Phase

Earth clearing

The earth clearing phase of the project entails the earth clearing of specific vegetation at the area of constructions, the levelling (cut and fill) of the surfaces as per designs of buildings to be erected.

The earth clearing activities are located at the village construction camp, plant area and along the access roads to the site. The majority of the noise from this phase is temporally and the noise generated is irregular, making it difficult to determine the exact sound levels at receivers. The sound power levels were calculated over the different areas, to represent the worst case scenario and possible maximum noise level that the receiver might receive from the source.

The table below indicate the environmental risk ratings and also the associated mitigated rating.

Table 24: Environmental risk rating table for construction – earth clearing scenario

	Extent	Duration	Frequency	Intensity	Probability	Cumulative
Earth Clearing	2	2	3	<1	3	10 (Medium)
Mitigated	2	1	2	<1	3	8 (Medium)

As the operations results in a change in noise level at the closest receiver in the village (SR_13 to SR_15) no more than Δ+1 dBA, the severity of the impact is negotiable to very low. The mitigation of the sources is up to the site management to ensure all operations runs smoothly and to have good open communications with the community.

Plant Establishment

The plant establishment phase focuses on the building and construction of the plant, this includes the delivery of equipment and plants to be assembled onsite. Also the general construction noises associated with the activities. The noise generated will only be during the construction time-frames and is difficult to mitigate as the noise is irregular and incidents of high-impact noise is unpredictable (falling pipes, falling equipment, etc.).

The table below indicate the environmental risk ratings and also the associated mitigated rating.

Table 25: Environmental risk rating table for construction – plant establishment scenario

	Extent	Duration	Frequency	Intensity	Probability	Cumulative
Plant establishment	2	2	3	<1	3	11 (Medium to High)
Mitigated	2	1	2	<1	3	9 (Medium)

Similar to the previous scenario, the operations results in a change in noise level at the closest receiver in the village (SR_13 to SR_15) no more than Δ+1 dBA, the severity of the impact is negotiable to very low. The mitigation of the sources is up to the site management to ensure all operations runs smoothly and to have good open communications with the community.

8.2 Operational Phase

Opencast Mining

The nature of the impact is associated with heavy vehicle movement, blasting activities, drilling operations, crushing and screening and material handling, together with the general day-to-day activities that occurs on a mine. The noise is strong in the lower frequencies of the spectrum. The noise will occur during the active operations at the mine. This scenario looked at the noise generated from opencast mining and propagated over the existing terrain.

The table below indicate the environmental risk ratings and also the associated mitigated rating.

Table 26: Environmental risk rating table for operations – Opencast operations

	Extent	Duration	Frequency	Intensity	Probability	Cumulative
Earth Clearing	2	3	3	<1	3	Medium to High
Mitigated	2	3	2	<1	3	Medium

Mitigated: The night-time noise levels are insignificantly impacted by the operations of the mine , the majority of the impact occurs during the daytime operations of the mine. Although limited mitigation can be prescribed, it is suggested that the noise generated from the crushing and screening plant be reduced. This can be done by cladding the plant, if engineered designs allow for. The cumulative reduction by doing this is between 1-2 dBA.

Underground Mining

Similar to the previous scenario this scenario investigated the propagation of noise from the opencast mining operations, however during this scenario the underground mining activities is also included and the terrain file is updated with the possible dimensions of the waste rock stockpile. The terrain has an influence on the propagation of the sound. The impact of the noise on the closest receiver is looked at in the table below.

Table 27: Environmental risk rating table for operations – Underground and opencast operations

	Extent	Duration	Frequency	Intensity	Probability	Cumulative
Earth Clearing	2	3	3	<1	3	Medium to High
Mitigated	2	3	2	<1	3	Medium

Mitigated: During the mining of the open pit, the terrain will screen some of the noise generated at the mine sites. The noise at the plant should be mitigated by means mentioned in the recommendations and will equate to a reduction of 80% in the sound energy per source.

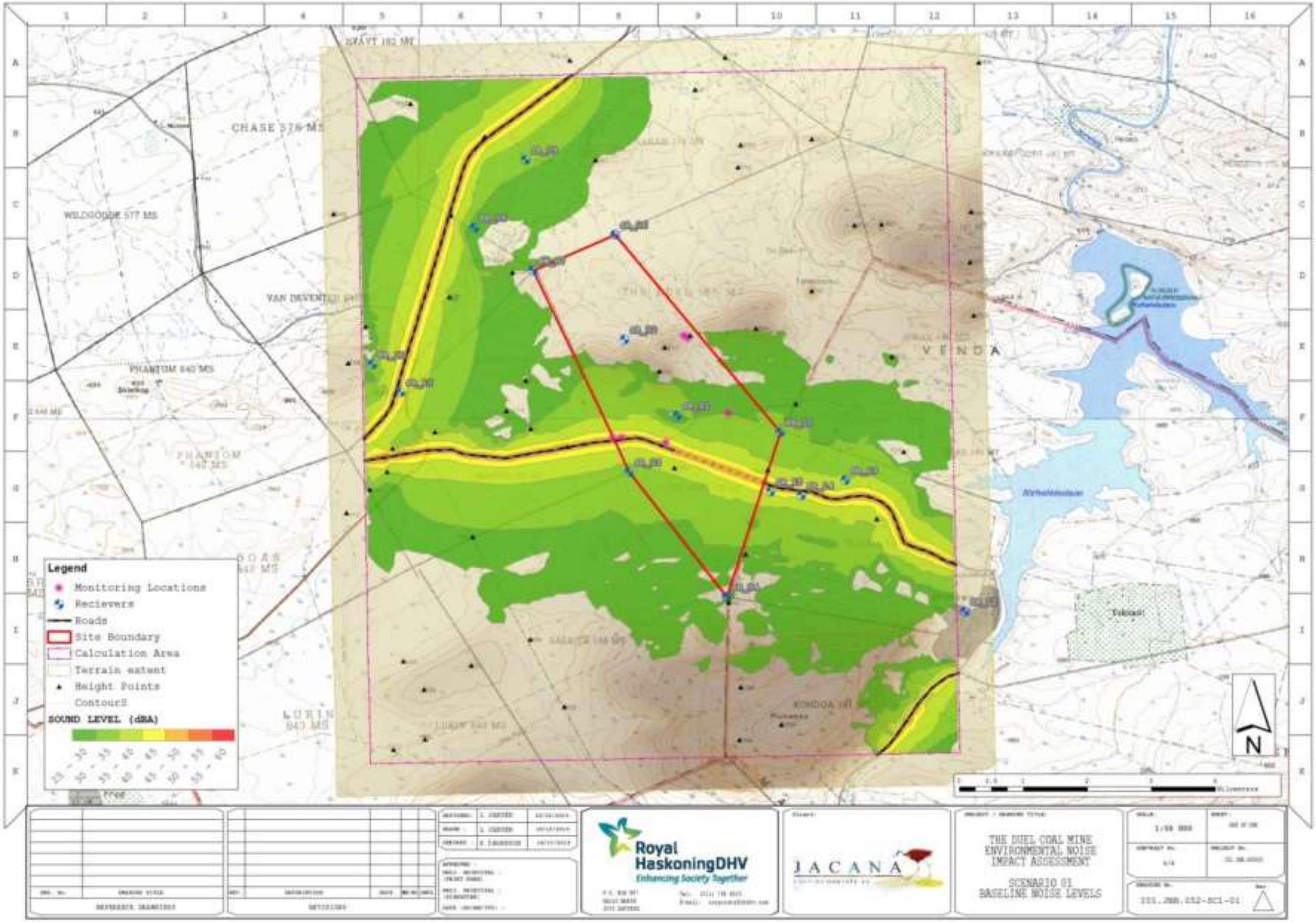


Figure 14: Scenario 01 (Daytime) Baseline Noise Modelled Results

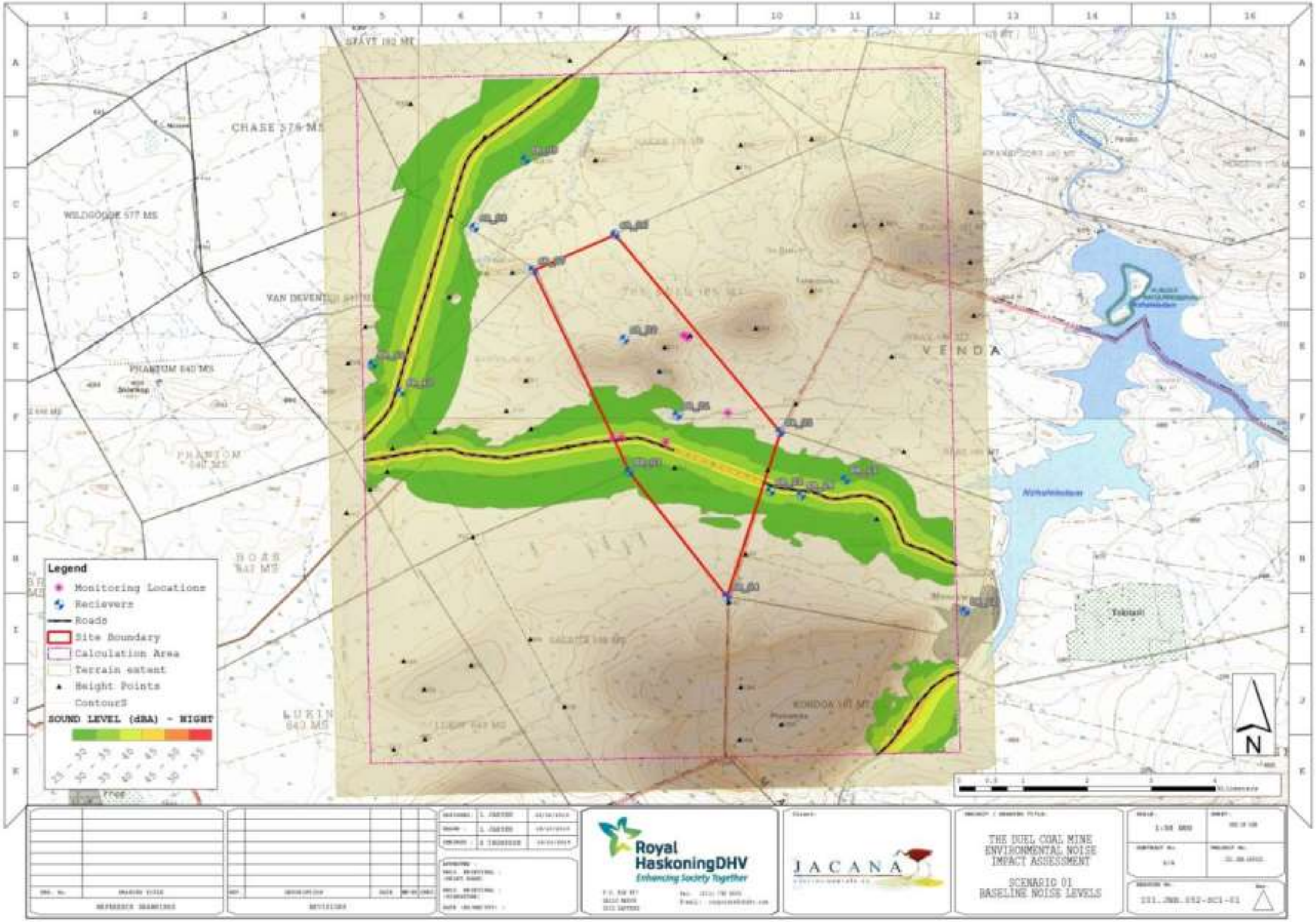


Figure 15: Scenario 01 (Night-time) Baseline Noise Modelled Results

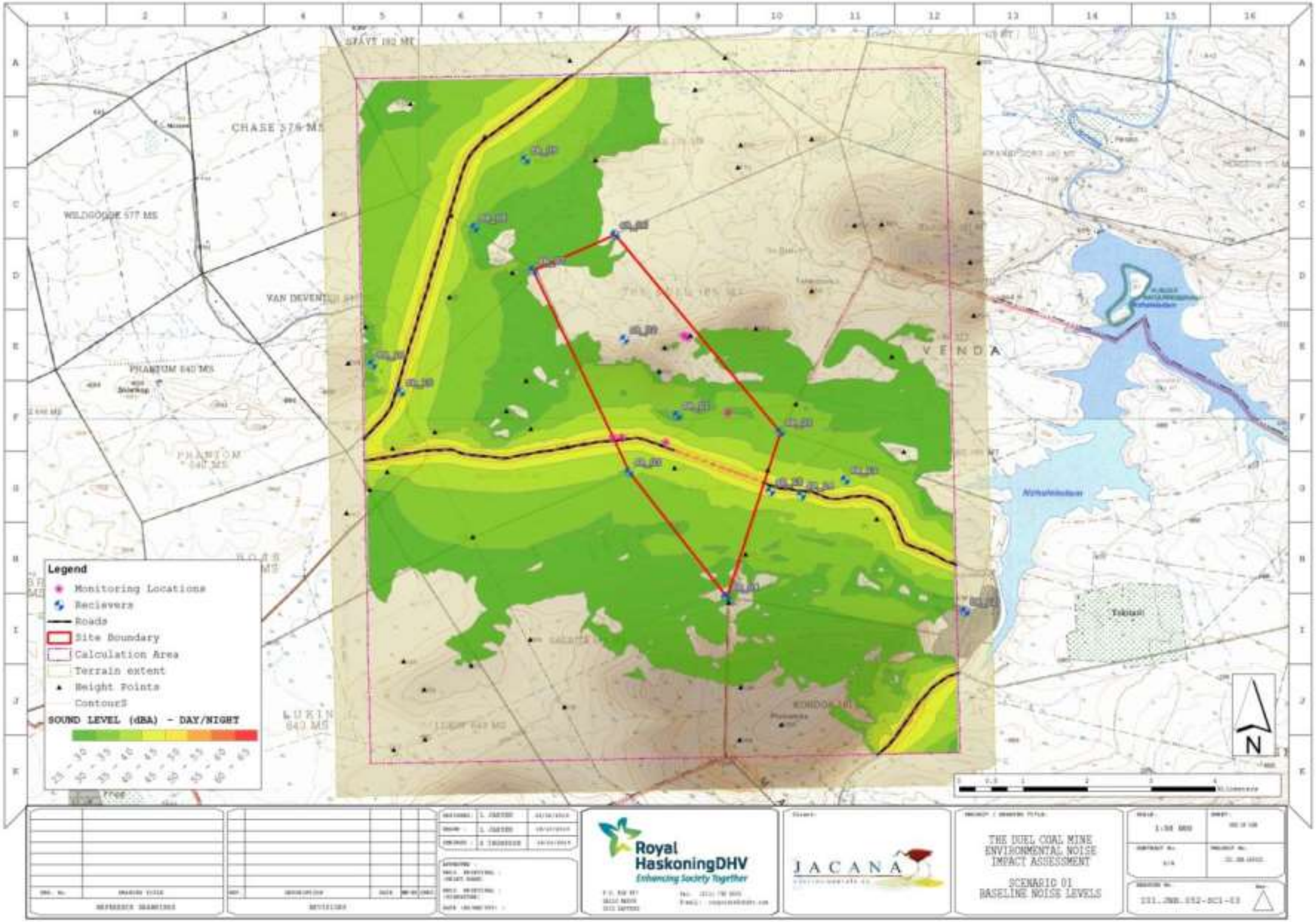


Figure 16: Scenario 01 (Day/Night) Baseline Noise Modelled Results

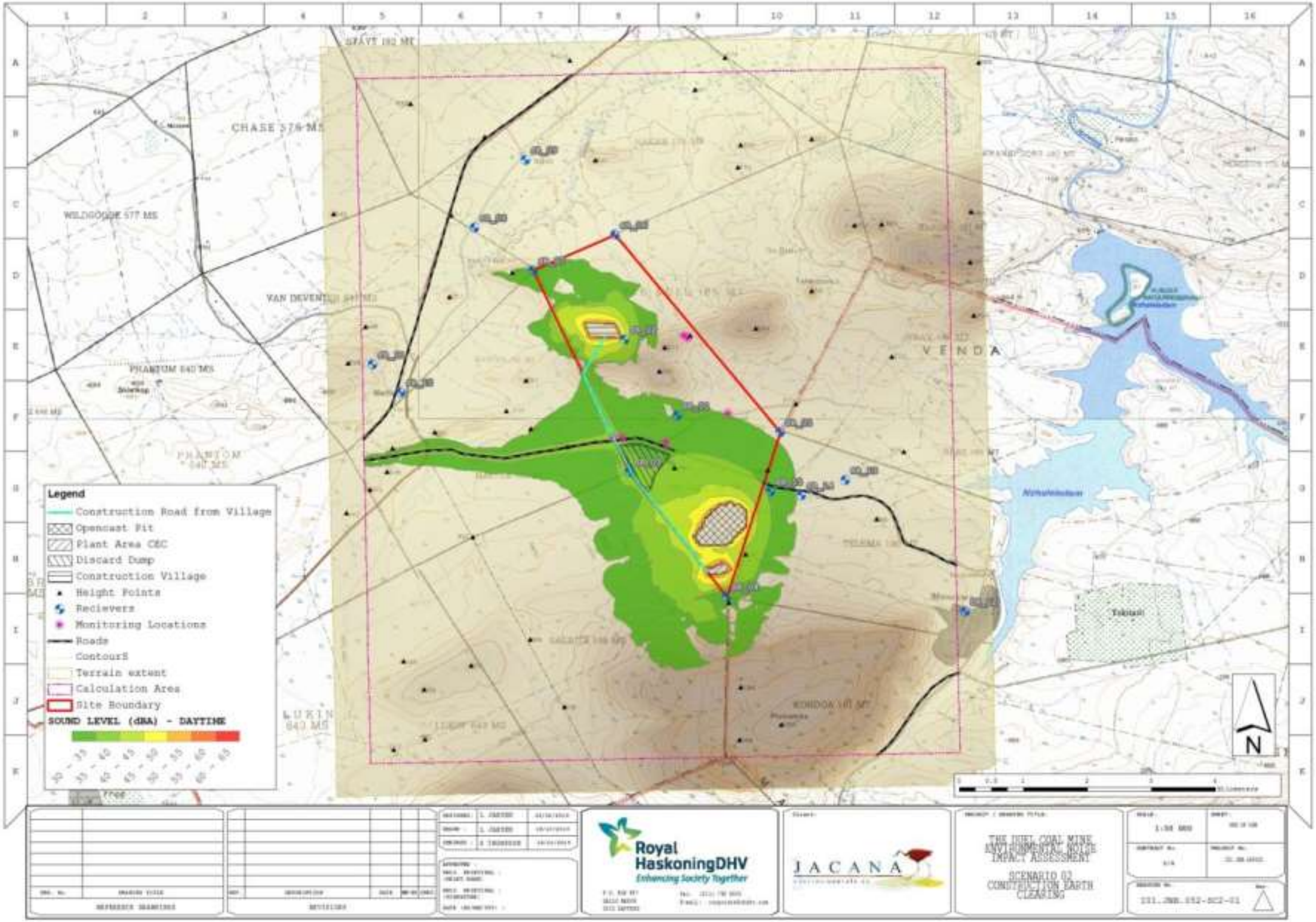


Figure 17: Scenario 02 (Daytime) Construction Phase – Earth Clearing Activities' Modelled Results

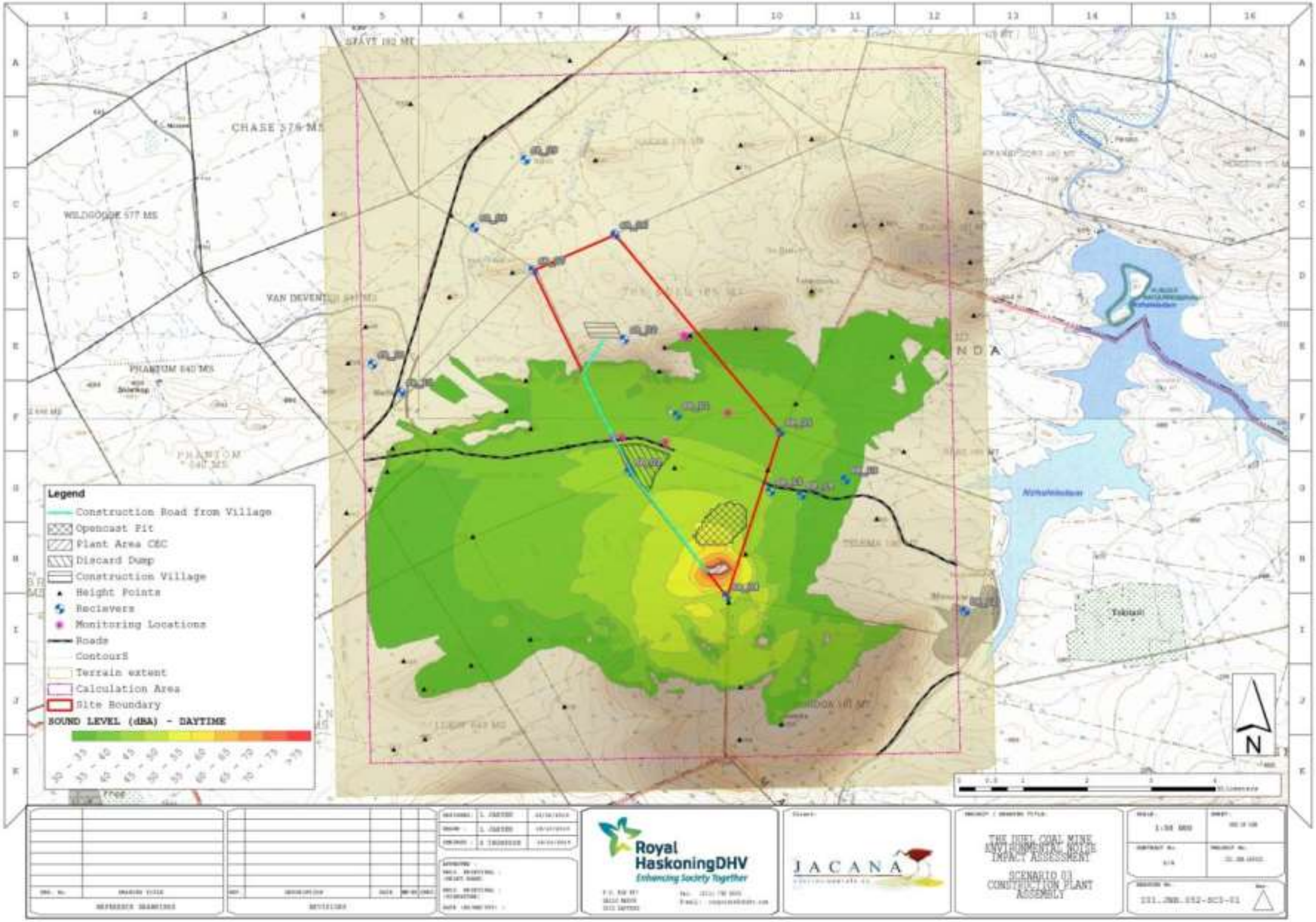


Figure 18: Scenario 03 (Daytime) Construction Phase – Plant Construction Activities' Modelled Results

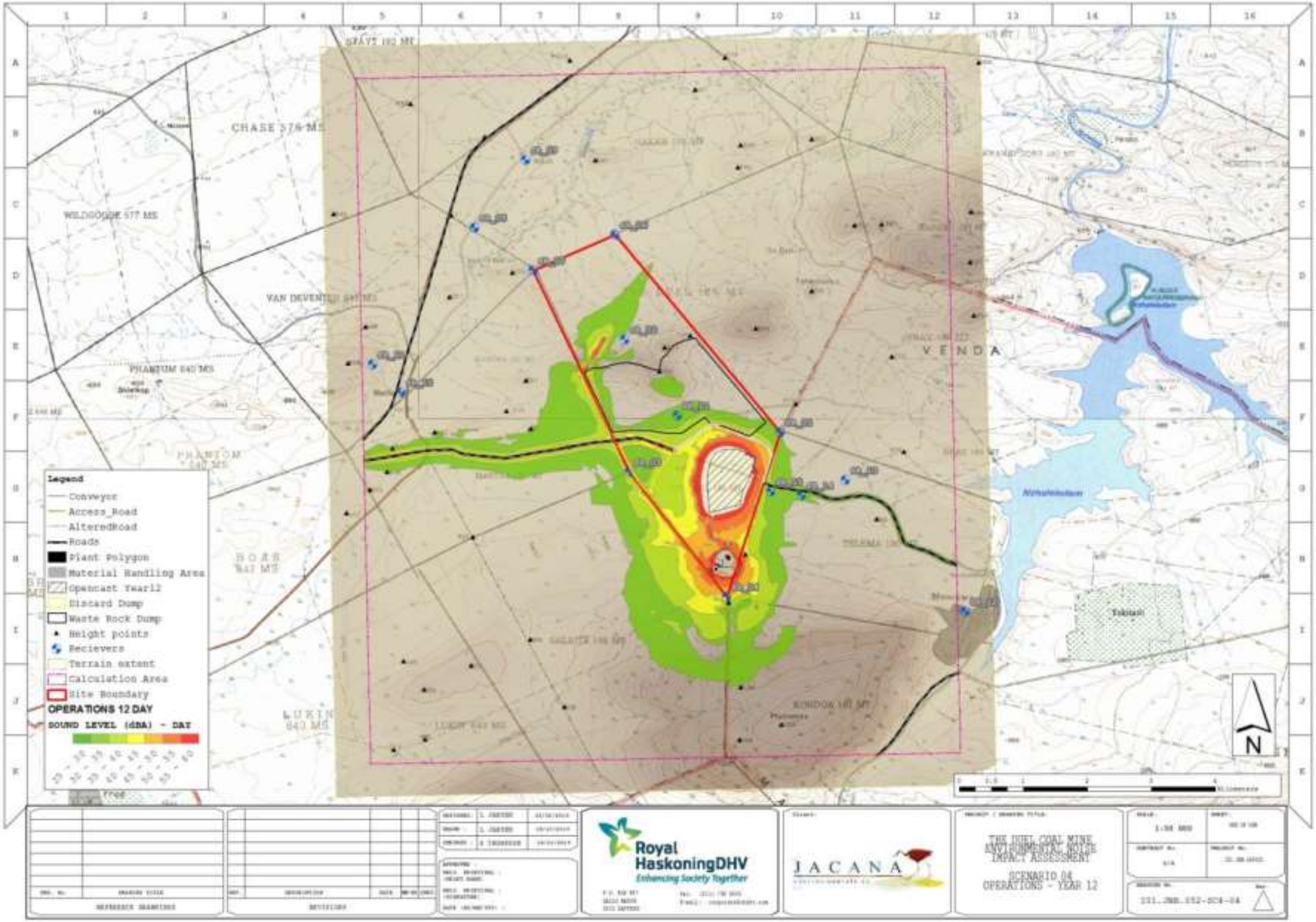


Figure 19: Scenario 04 (Daytime) Operational Phase Activities' Modelled Results (Opencast)

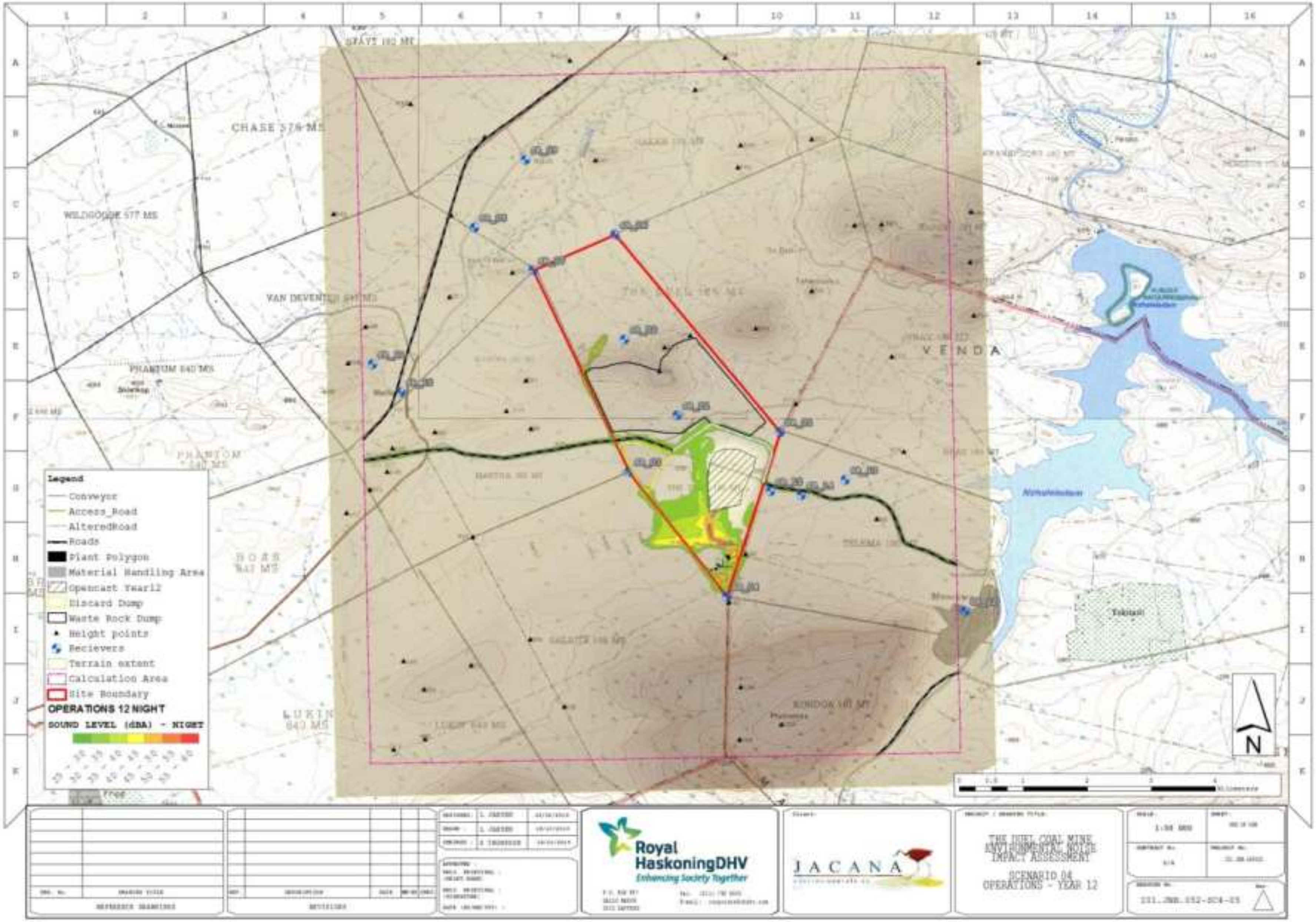


Figure 20: Scenario 04 (Night-time) Operational Phase Activities' Modelled Results (Opencast)

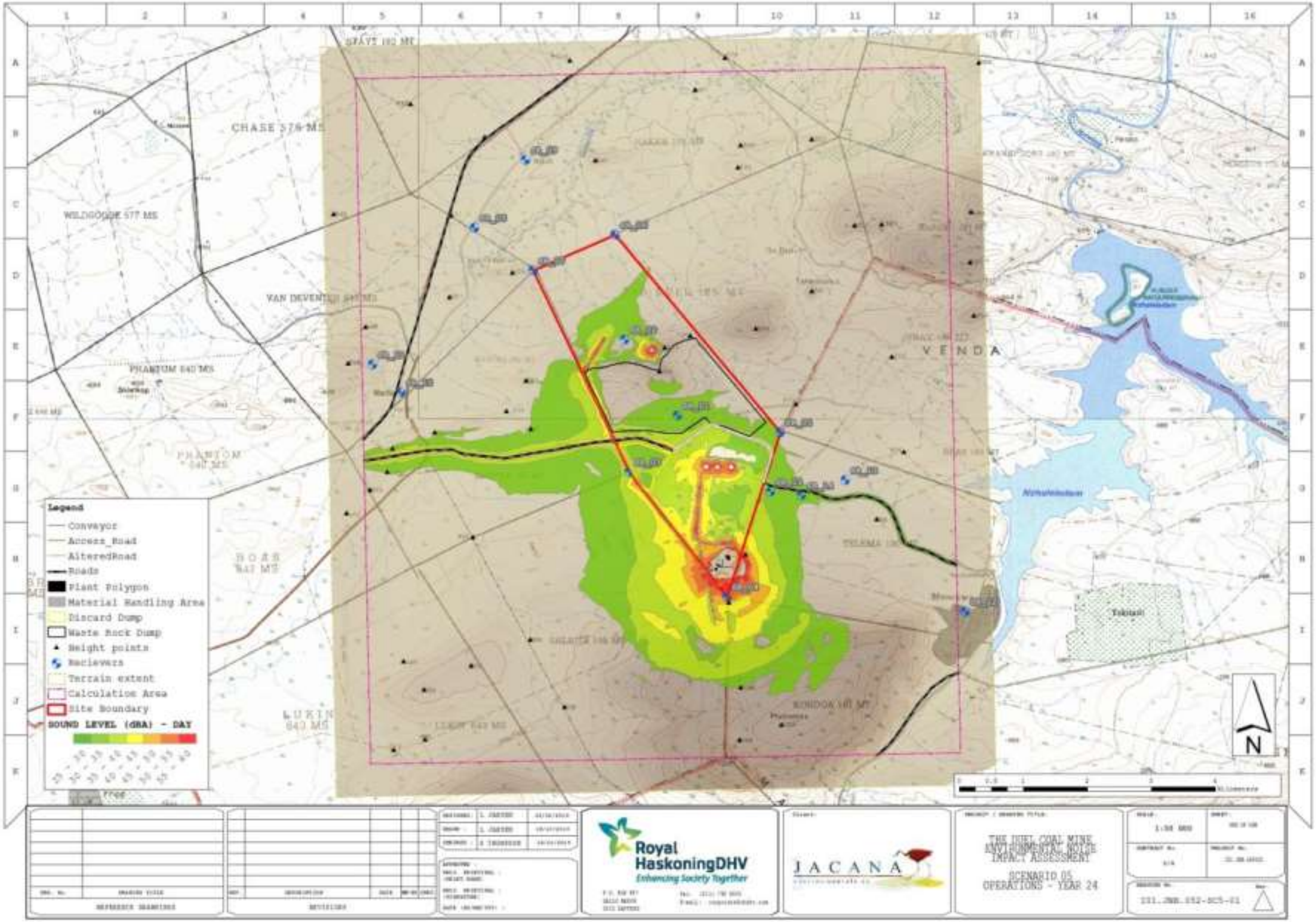


Figure 21: Scenario 05 (Daytime) Operational Phase Activities' Modelled Results (Underground)

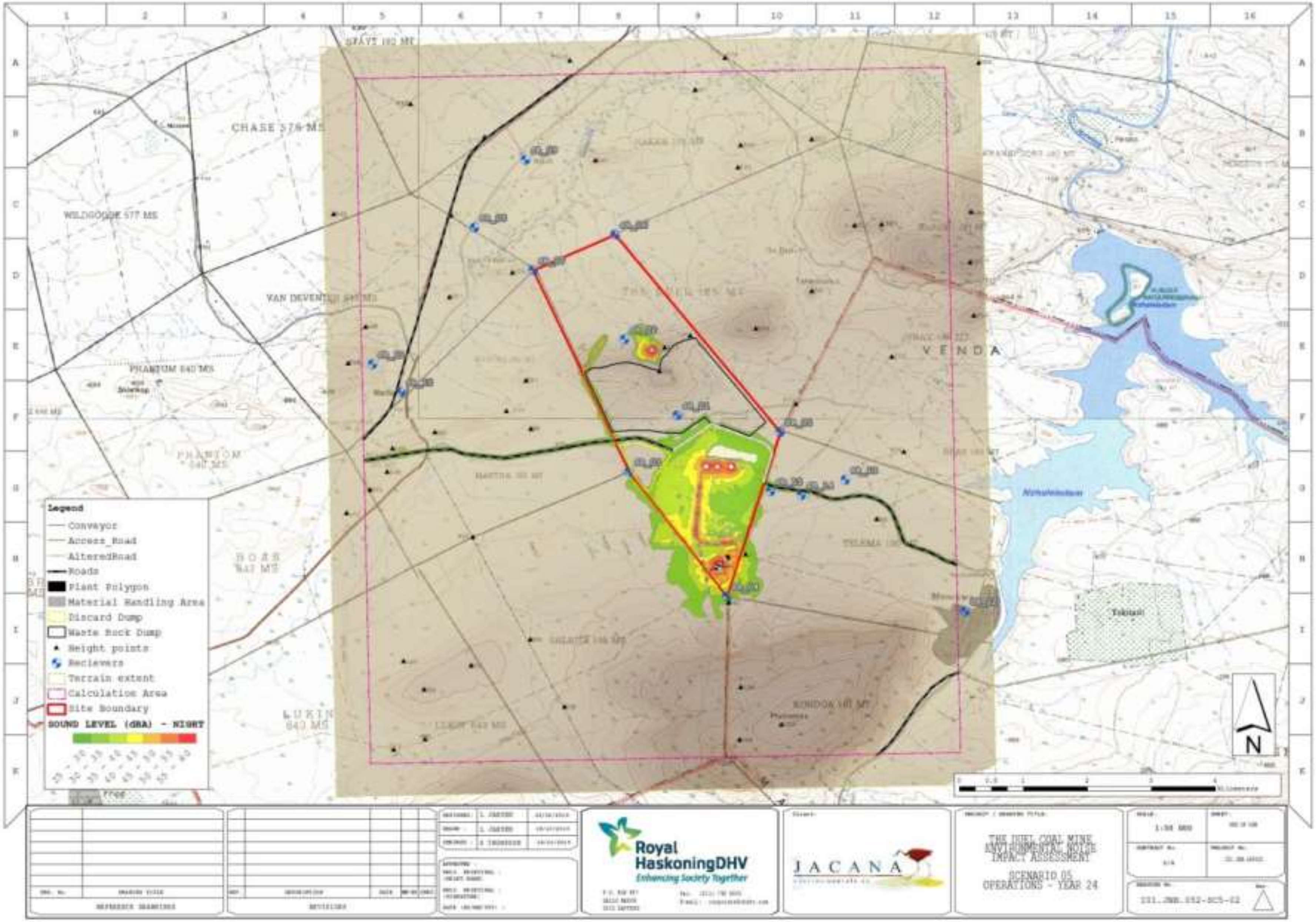


Figure 22: Scenario 05 (Night-time) Operational Phase Activities' Modelled Results (Underground)

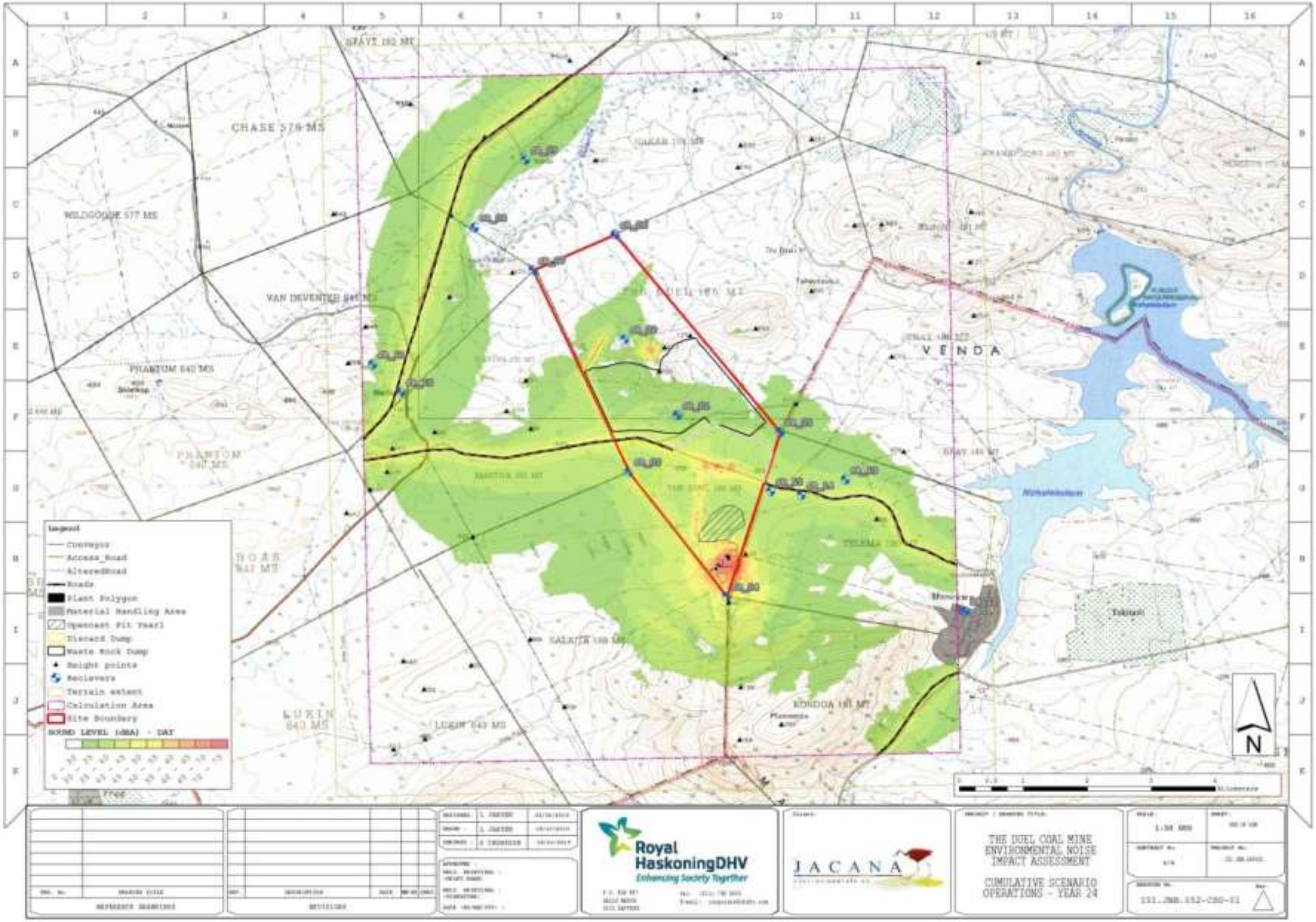


Figure 23: Cumulative presentation of the noise expected during the underground mining phase in the region (Daytime)

9 Conclusion

The project proposed will generate an increase in the available coal reserves of the country and uplift the surrounding community with much needed employment and infrastructures. The locality of the site will enable the owners to either sell coal to the neighbouring countries or to the new power stations of South Africa.

Following the national legislation, a full environmental impact assessment must be conducted before the project can start construction, this report forms part of the complete and full environmental impact assessment (EIA). In Section 3, a summary of the legal framework is provided and project specific guidelines are prescribed in section 3.3. The environmental impact significance rating methodology is described in Appendix B.

The baseline assessment of the region of the proposed project indicated that the region is very quite, typical of the rural environment. The topography of the study area is mountainous with typical savannah and bushveld vegetation cover. In the study area there are minimal noise generating sources, the major existing noise source being the access gravel road. The small village of Makushu is located on the eastern border of the mining property and is likely to be impacted by the new operations. In saying this, the environmental risk rating based on the findings calculated per receiver SR_13, SR_14 and SR_15 indicated the overall impact is low.

However, during the operational phase the impact is increased during the night- due to the continuous operation nature of the mine. These impacts can be mitigated by various options made available to the client, an additional mitigation measure that can be implemented during the start of the life cycle of the mine, is to establish an earth berm surrounding the plant processing area.

The impact expected to arise from this project can be divided into two phases, 1) Construction and 2) Operational. During the construction of the project, the noise will be limited to daylight hours (~06:00 to 18:00), and is likely to be only local to the proposed plant site and open pit area. The noise generated can easily be stopped and mitigated once found there is a nuisance associated with the activity.

The operational phase of the project will likely produce noise during blasting events, handling of ROM and processing plant noises. The mine is likely to be active 24hours a day, causing a significant increase in the noise levels during the night. It is strongly suggested that the mining operations be limited or stopped during the night hours to limit the noise nuisance impact on the sensitive receiver SR_15 and the community it forms part of.

Table 28: Conclusive table indicating the maximum results received by the receptors and the associated phase of the project

ID	Highest noise level modelled	Description of Noise source	Future calculate noise level (dBA)	Difference in noise level (potential increase in noise).
SR_01	38.5	Daytime - Plant assembly (Plant Area Assembly)	38.9	**+10.3**
SR_02	46.7	Day/Night - Earth clearing (Contractors camp site)	46.7	**+24.3**
SR_03	45.6	Daytime - Operational Underground (Construction Campsite Road)	46	**+11.1**
SR_04	49.1	Daytime - Plant assembly (Plant Area Assembly)	49.1	**+21.3**
SR_05	37.3	Daytime - Plant assembly (Plant Area Assembly)	38.3	+6.8
SR_06	27.3	Day/Night - Earth clearing (Contractors camp site)	29.3	+4.3
SR_07	36.9	Day/Night - Earth clearing (Contractors camp site)	37.2	**+12.4**
SR_08	20	Day/Night - Earth clearing (Contractors camp site)	30.2	+0.4
SR_09	28.2	Day/Night - Earth clearing (Contractors camp site)	34.7	+1.1
SR_10	23.5	Day/Night - Earth clearing (Contractors camp site)	43.9	+0.0
SR_11	24.8	Day/Night - Earth clearing (access road noise associated with project)	35.6	+0.4
SR_12	17.8	Daytime - Plant assembly (Plant Area Assembly)	23.9	+1.2
SR_13	31	Daytime - Plant assembly (Plant Area Assembly)	37.6	+1.1
SR_14	35.4	Daytime - Plant assembly (Plant Area Assembly)	43.7	+0.7
SR_15	40.4	Daytime - Plant assembly (Plant Area Assembly)	44.8	+1.9

9.1 Recommendations

To control the noise from the coal mining operations the following key points are highlighted by Royal HaskoningDHV to be investigated and implemented:

- Control of noise - Onsite
  - Avoid unnecessary revving of engines and switch off equipment when not required;
  - Keep internal hauling roads well maintained and avoid steep gradients;
  - Minimise drop height of materials;
  - Start up plant and vehicles sequentially rather than all together.
  - Ensure that all the equipment and operations employed at the site is of the latest and quietest technologies;
  - Fitment of additional or best available exhaust silencers or acoustic canopies on engines;
  - Where possible, attempt to enclose noise sources, if the sources enclose has a noise directivity ensure the noise is directed away from any communities;
  - Regular and effective maintenance by trained personnel is essential and will do much to reduce noise from plant and machinery;
- Controlling the spread of noise
  - Increase the distance from source to receiver – siting equipment and noisy activities as far as possible from the noise sensitive area or receivers;
  - Screening of noise sources, if it isn't possible to increase the distance, the alternative measure is to screen the noise source. Screening can make use of the natural environment, existing buildings and/or screens or earth berms. These screens should be placed in the direct line of sight to effectively reduce the noise received and the sensitive location.
- Noise control targets
  - Monitoring of noise at sites where noise is an issue should be regarded as essential. Measurements may be carried out for a number of reasons, including the following:
    - To allow the performance of noise control measures to be assessed;
    - To ascertain noise form items of plant for planning purposes;
    - To provide confirmation that planning requirements have been complied with.

    Monitoring positions should reflect the purpose for which monitoring is carried out.

Appendices

Appendix A – Sound Power Level Inventory

Appendix B - Environmental Impact Significance Rating Methodology

Appendix C – Environmental Noise Monitoring Interim Report

Appendix A – Sound Power Level Inventory

Appendix B – Environmental Impact Significance Rating Methodology

1 ENVIRONMENTAL IMPACT ASSESSMENT APPROACH

1.1 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- **Nature**: A brief written statement of the environmental aspect being impacted upon by a particular action or activity.
- **Extent**: The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration**: Indicates what the lifetime of the impact will be;
- **Intensity**: Describes whether an impact is destructive or benign;
- **Probability**: Describes the likelihood of an impact actually occurring; and
- **Cumulative**: In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Table 29: Criteria Used for the Rating of Impacts

CRITERIA	DESCRIPTION				
	5	4	3	2	1
EXTENT	**International (5)** International scale	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the site boundaries	**Site (1)** Within the site boundaries
DURATION	**Permanent (5)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (4)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (3)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (2)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few months)	**Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few days)
FREQUENCY	**Continuous (5)** Daily to a significant percentage every day	**Very Frequent (4)** Few times a week to daily	**Frequent (3)** Few times a month	**Unusual (2)** Once or twice every 5 years	**Very Rare (1)** Once or twice a decade
INTENSITY	**High (5)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**Medium High (4)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Medium (3)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (2)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected	**Very Low (1)** Impact does not affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILTY OF OCCURANCE	**Definite (5)** Impact will certainly occur	**Very Likely (4)** Most likely that the impact will occur	**Likely (3)** The impact may occur	**Probable (2)** Likelihood of the impact materialising is low	**Improbable (1)** Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 30: Criteria for the rating of classified impacts

Low impact (0 -5 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Medium impact (6 -10 points)	Mitigation is possible with additional design and construction inputs.
Medium to High impact (11 -15 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
High impact (16 - 20 points)	High consequences and mitigation is essential.
Extremely High	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a “very high impact” is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the status quo – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.	

Note: When a negative impact is recorded, it is important to note that a lower negative value (e.g negative 5) is *preferable* to a higher negative value (e.g. negative 7), as the higher negative value represents an impact of greater magnitude.

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

Appendix C – Environmental Noise Monitoring Interim Report

Royal HaskoningDHV
Enhancing Society Together

Date 19th September 2014

Our Ref: Environmental Noise Survey Interim Report
Email reply to: lodewyk.jansen@rhdhv.com
Your Ref: The Dual Coal Mine - Environmental Noise Specialist Interim Report

Jacana Environmentals CC
7 Landdros Mare Street
Polokwane
0759

Attention: Marietjie Eksteen

Environmental Noise Specialist – Survey Interim Report

The site visit was conducted on the 15 - 17th September 2014 at *The Dual Coal Mine* project. The conditions at the site were typical of rural/natural conditions. There was little traffic passing by on the gravel road that passes through the site. The noise survey consisted out of four monitoring points, where after the specialist deployed the 24-hour noise level meter. The reason for stopping the noise surveying was the area has no existing sources, expect for the existing road and the activity from the noise specialist would be the highest local noise source.

The noise specialist (Lodewyk Jansen) followed the guidelines and recommendations, setout in SANS 10328 and SANS 10103, on the type of sound level meter to use and the positioning of the sound level meter. Field notes were recorded during the monitoring at each of the locations. The specific details of the sound level meter used are provided below:

Sound level meter (Type1)		Sound level meter calibration unit	
Make of sound level meter:	**Casella Instruments**	Make of sound level calibrator:	**Casella Instruments**
Model of sound level meter:	**CELL 633 C1**	Model of sound level calibrator:	**CEL 120/2**
Serial number of unit:	**2939299**	Serial number of unit:	**2539358**
Date of previous calibration:	**15 August 2014**	Date of previous calibration:	**15 August 2014**

The purpose of this interim report is to give feedback on the site visit and to highlight any issues or concerns that might have been picked up by the specialist during the site visit:

1. The noise climate of the region is higher closer to the road; and
2. The noise climate in the region is very low and undisturbed.

The following pages list the results and summary of the findings during the site visit.

As mentioned earlier th daytime noise level results are indicated below.

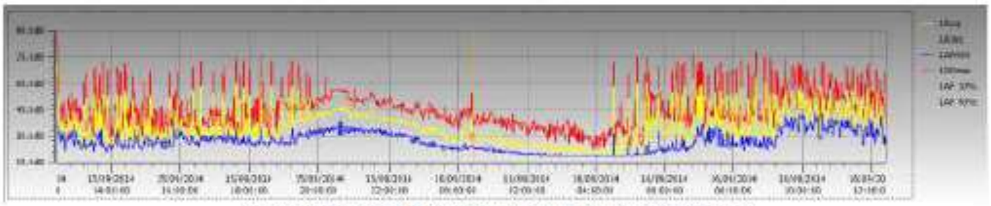
ID	Name	LAeq (dBA)	LAmin (dBA)	LAmax (dBA)	Description
PS_01	Hill top	38.2	21.6	66.6	Natural conditions, no audible sound sources, some calls from birds were recorded.
PS_02	Eastern side	35.4	20.6	54.0	Natural conditions, no audible sound sources, some calls from birds were recorded.
PS_03	Access road	36.0	21.1	68.1	Cars travelling on the gravel road is audible, birds and insects present.
PS_04	Western corner	40.7	22.3	65.0	Cars travelling on gravel road audible and a faint humming from the south was audible.

The noise level meter was deployed for a 24-hour recoding on 15 September 2014 at 12:30. In summary the noise level meter recorded the vehicles passing on the gravel road and bird calls during sunset and sunrise. The LAeq for the whole 24hour period was 46.0 dBA with a recorded minimum of 20.2 dBA (04:45) and a maximum of 62.9 dBA.

The calculated continuous equivalent rating level for the 24hour period is 50.5 dBA ($L_{Req,dn}$) with the daytime rating level of 49.7 dBA ($L_{Req,d}$) and night-time rating level of 42.7 dBA ($L_{Req,n}$). in evaluating these noise levels to Table 2 of SANS10103, the 24-hour noise monitoring location falls with in the land use description *B – Suburban districts with little road traffic*. The major impact on the noise level at this 24-hour monitoring point was the traffic passing on the gravel road. The surface of the gravel road causes higher noise levels that expected from tarred surfaces. An additional monitoring point was measured further away from the road at the hill top location.

The noise level meter was deployed for a 24-hour recoding on 16 September 2014 at 14:00. In summary the noise level meter recorded mainly bird calls during sunset and sunrise. The LAeq for the whole 24hour period was 39.6 dBA with a recorded minimum of 20.9 dBA and a maximum of 79.4 dBA.

The calculated continuous equivalent rating level for the 24hour period is 42.1 dBA ($L_{Req,dn}$) with the daytime rating level of 41.2 dBA ($L_{Req,d}$) and night-time rating level of 34.5 dBA ($L_{Req,n}$). in evaluating these noise levels to Table 2 of SANS10103, the 24-hour noise monitoring location falls with in the land use description *A – Rural*. During the review of the recordings and graph less car impacts could be seen and the major noise triggers were recordings of birds.



24-hour graph of first location close to the gravel road.

In summary the area is classified as natural with little noise disturbances in the area (gravel road). The typical baseline noise level for the whole study area is 42 – 50 dBA. Where the noise level significantly drop during the night (as no noise sources are present) to a range of 35 – 43 dBA.